BIOMASS STUDY

CARTWRIGHT AND BLACK TICKLE, LABRADOR

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Prepared for:

Eagle River Development Association
Cartwright, Labrador

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EXECUTIVE SUMMARY

1. Objective and Methodology

This study was undertaken to assess the potential to increase the use of biomass fuel in the Communities of Cartwright and Black Tickle, and in this way, reduce consumption of imported oil. First the existing situation was investigated and forecasts were made for future developments assuming that no major infrastructural changes are made. Next infrastructural and organizational changes were recommended and their impact on the use of fuel wood investigated.

2.1 Residential Heating Fuel Demand

In both Cartwright and Black Tickle, biomass fuel (wood) already forms the largest category amongst domestic heating fuels. In Cartwright 85% of the homes use wood either exclusively or in combination with oil or electricity, in Black Tickle 61%. In Cartwright 70% of the people who currently burn wood, always burned wood; in Black Tickle 60% switched over in 1981 and 1982.

Most people in Cartwright who still burn oil at the moment do so because they have no physically able, unemployed person in the home who can get firewood, or because they live in Federally owned housing units and are not responsible for their heating cost. The last category has no incentive to conserve oil or to convert to biomass fuel.

In Black Tickle most people who burn oil at the moment do so because they have no physically able, unemployed person in the home, who can get firewood or because their wood supply is so far away (42 km average haul).

So, without major infrastructure changes, the saturation level has been reached in both communities and very few additional homeowners will convert from oil to wood. Actually, the reverse may be true, when distances to wood supplies continue to increase, and oil prices stabilize or drop, or when the local economy improves as a result of improvements in the fishery. When some or all of these things happen, some people will convert back to oil.

Fuel demands could also drop when homes are retrofitted or use more energy efficient stoves. Present insulation values are far below recommended standards, and a major effort should be made to educate the people about the benefits of retrofitting.

Finally, fuel demands could drop as a result of a shrinking of the population like is demonstrated in Cartwright, where the population dropped from 752 in 1971 to 580 in 1985. In Black Tickle, after a period of stagnation from 1976 - 1981, the community seems to be growing again slowly to a current population of 220.

The annual cost to heat a typical home in Cartwright and Black Tickle exclusively with oil, wood or electricity is tabulated below:

	Cartwright	Black Tickle
Oil heated home	$1,952.35	$4,280.00
Wood heated home, incl. labour cost	1,844.83	5,773.40
Wood heated home, excl. labour cost	683.23	3,050.68
Electrically heated home	2,510.97	4,325.55

From this table can be concluded that at the present hauling distance of 10 km for Cartwright, wood heating is still more economical than heating with oil or electricity, even when the cost of labour is taken into account at $4.00 per hour. Excluding the cost of labour, they can save on the average $1,270.00 per year on their annual heating bill by burning wood instead of oil.

In Black Tickle, because of the longer haul (42 km average), when the cost of labour is taken into account at $4.00 per hour, wood heating is the most expensive form of heat. When no value is placed on the labour component of getting firewood, wood is approximately $1,230.00 per year cheaper than oil. Obviously in Black Tickle, people get a very poor return for their effort, but may have no other choice, due to poor financial circumstances.

The typical cost for people in Cartwright and Black Tickle to get firewood and look after their wood heating system was found to be:

	Cartwright	Black Tickle
Direct Cost (gas and oil)	$ 36.54/cord	$ 86.83/cord
Indirect Cost (repairs, maintenance of snowmobile, komatik, saw, clothing, etc.)	41.10/cord	110.37/cord
Subtotal	$ 77.64/cord	$197.20/cord
Labour cost (@ $4.00 per hour)	132.00/cord	176.00/cord
Total cost	$209.64/cord	$373.20/cord

We found that wood could be shipped from Goose Bay to Cartwright or to Black Tickle F.O.B. dock for only about $72.00 per cord. So from a strictly economic viewpoint it would be better for people from both communities to import their wood from Goose Bay, than to cut it themselves and haul it in komatik* loads.

2.2 Commercial and Institutional Heating Fuel Demands

The commercial and institutional buildings in Cartwright and Black Tickle use mainly oil as heating fuel (83% of their combined net energy demand). Most premises in those categories are either not occupied 24 hours per day, or their occupants are full time employed and have no time to look after a wood heating system. Without major Government subsidies or other incentives, it will not be feasible for each of them to convert to wood on an individual basis.

2.3 Power Plant Fuel Demand

The largest consumers of petroleum based fuel in Cartwright and Black Tickle are the power plants, which consume respectively 67% and 63% of all oil burned in these communities (actual quantities are 630,430 litres in Cartwright and 339,790 litres in Black Tickle).

Acres Consulting Services Limited recently carried out a study to convert diesel power plants in Roddickton, Main Brook and Croque to biomass fuel. They found that only with the largest of the three, in Roddickton, conversion would be feasible. Because the Cartwright electrical demand is less than one quarter of the Roddickton diesel generated energy demand, and the Black Tickle demand is even less than the Main Brook electrical demand, it was considered not feasible for the Cartwright and Black Tickle power plants to convert to wood without significant Government subsidies.

*A komatik is a sledge

3. Impact of Government Incentives

Although the prospects for increased future use of fuel wood in Cartwright and Black Tickle are not very good, there are ways to promote the conversion from oil to wood. All of these require Government incentives to get set up, but could conceivably support themselves afterwards.

Most of these incentives are not economically feasible from an "off-oil" conversion perspective only, but because they could create considerable local employment, and could have social benefits, they may be attractive to Government from a combined socio-economic and employment viewpoint.

3.1 Methods to Increase Residential Fuel Wood Demand

Residential fuel wood demand in Cartwright and Black Tickle can be increased by lower cost and better availability. This can be accomplished by new infrastructure and by organization.

The infrastructure could be an access road for the Cartwright area and secure wood storage depots in both communities, which would facilitate the harvesting of wood in bulk during the fall. The depots would also be required if wood is imported from Goose Bay by coastal boat during the summer months.

Organizational requirements would be to set up the depots and access road construction & to try to get the private sector to run the depots. In case of lack of interest from the private sector, the Development Associations should initially manage the depots for one year, to prove their viability. After that period, they should again attempt to transfer them over to the private sector, by putting them up for bids.

Cost of a depot for 1150 cords in Cartwright is $35,000, and for a 400 cord depot in Black Tickle, $25,000. Cost of a 16 km access road towards Paradise River is estimated to be $800,000. Docks in Cartwright and Black Tickle are adequate to handle the unloading of fuel wood, especially if it is shipped in smaller quantities e.g. 100 cords each week on the regular coastal boats.

3.2 Methods to Increase Commercial and Institutional Fuel Wood Demand

The above mentioned infrastructure and organization need to be in place before any increases in the commercial and institutional demand can be expected. These sectors however, require something extra to convert from oil to wood. They require Government grants to defray part of the cost of converting from oil to wood, similar to the COSP* grants, but they will further require an "Energy Supply Agency" that will look after their heating systems on a day to day, and on a contract basis.

This, of course, can only be feasible if a large enough number of buildings participate, and is therefore out of the question for Black Tickle. In Cartwright, where the annual heating cost of these two sectors is $75,000, there appears to be some potential. Again, ideally a private sector firm should run the "Energy Supply Agency", however if no businesses or individuals are interested, the Development Association could run it for the first year to get it organized. After that year, it could be put up for bids, together with the fuel wood depots.

*COSP - Canada Oil Substitution Program

3.3 Methods to Increase Power Plant Fuel Wood Demand

The only way that Newfoundland and Labrador Hydro would convert its power plants in Cartwright from oil to wood, is if sufficient Government incentives are provided under employment creation programs, to make it feasible for the Utility Company to convert. Because there is no real wood supply in the Black Tickle area, it is highly unlikely that its power plant will be converted from oil to wood. Cartwright, because of its larger size and availability of wood, has the most potential.

4. Conclusions and Recommendations

From a strictly economic viewpoint it is cheaper to import wood from Goose Bay than to cut it locally in both Cartwright and Black Tickle. To encourage "off-oil" conversion alone, one should encourage therefore the shipping of wood from Goose Bay to both communities, by means of setting up fuel wood depots close to the docks. This is recommended for Black Tickle. From a socio-economic perspective, it would be better for the community of Cartwright if its local wood supply is made accessible for trucks, by means of construction of an access road. A new 16 km long access road in the general direction of Paradise River would open up enough wood resources to supply the fuel wood demand for Cartwright for the next 20 years.

Fuel wood depots will require management and organization, which ideally should be provided by the private sector. The Development Association should arrange for that right from the start, if at all possible, or otherwise after one year of operation, when all bugs have been ironed out and they have proven that they can be a viable operation.

To enhance conversion from oil to wood by the commercial and institutional sector, the Development Association should further arrange for an "Energy Supply Agency", again if possible, managed by the private sector. It would tie-in to the management of the fuel wood depot. With the above described infrastructural and organizational changes, approximately 270,000 litres of oil can be converted to wood per year.

Finally, the conversion would really have a large impact on Cartwright, if the power plant would be converted as well, with the help of Government incentives. Assuming that 75% of the energy demand of the Cartwright power plant would be provided by wood, this would reduce oil consumption in Cartwright an additional 470,000 litres per year.

ETUDE SUR LA BIOMASSE

CARTWRIGHT ET BLACK TICKLE (LABRADOR)

Résumé

1. Objectif et méthodologie

Cette étude a pour but d'évaluer les possibilités d'augmenter l'utilisation du combustible biomassique dans les collectivités de Cartwright et de Black Tickle pour réduire la consommation de pétrole importé. On a tout d'abord procédé à une évaluation de la situation et établi des prévisions sur son évolution, en supposant qu'aucun changement important ne serait apporté à l'infrastructure. A partir de ces données, on a recommandé des modifications à l'infrastructure et à l'organisation et étudié les répercussions de l'utilisation du bois comme combustible.

2.1 Demande de combustible de chauffage dans les résidences

Tant à Cartwright qu'à Black Tickle, le combustible biomassique (bois) est déjà le plus utilisé des combustibles de chauffage résidentiel. A Cartwright, 85 % des maisons sont chauffées exclusivement au bois ou au moyen d'un système mixte bois/mazout ou bois/électricité. A Black Tickle, ce pourcentage atteint 61 %. A Cartwright, 70 % des utilisateurs ont toujours chauffé leur maison au bois et à Black Tickle, 60 % de ceux qui chauffent maintenant au bois ont commencé à le faire en 1981 et 1982.

La majorité des gens qui chauffent encore au mazout utilisent encore ce combustible parce qu'aucune personne valide et disponible ne peut leur procurer du bois ou parce qu'ils vivent dans des logements qui appartiennent au gouvernement fédéral et que, par conséquent, ils ne paient pas eux-mêmes les frais de chauffage. Ces derniers ne sont donc pas intéressés à économiser le pétrole et à utiliser l'énergie biomassique.

A Black Tickle, les gens qui chauffent encore au mazout le font parce qu'aucune personne valide et disponible à la maison ne peut leur procurer du bois de chauffage ou parce qu'ils devraient parcourir une trop grande distance pour s'en procurer (42 km en moyenne).

Par conséquent, si aucun changement important n'est apporté à l'infrastructure, on peut conclure que le niveau de saturation a été atteint dans les deux collectivités et que peu de propriétaires

modifieront leurs appareils de chauffage afin de l'alimenter au bois. En fait, l'inverse pourrait même se produire si les utilisateurs devaient parcourir une distance de plus en plus grande pour se procurer du bois, si les prix du pétrole se stabilisaient ou diminuaient ou si l'économie locale s'améliorait par suite de l'amélioration du marché des pêches. Si ces conditions se concrétisaient en tout ou en partie, certaines personnes retourneraient probablement au mazout.

La quantité de combustible demandée pourrait également diminuer par suite de rénovation des maisons et de l'utilisation de cuisinières à meilleur rendement énergétique. En effet, les niveaux d'isolation actuels sont bien en-deçà des normes recommandées, et il faudrait s'efforcer de convaincre les gens des avantages de la rénovation.

Enfin, la quantité de combustible demandée pourrait diminuer à cause de la baisse de la population. À Cartwright, elle est passée de 752 en 1971 à 580 en 1985. À Black Tickle, après une période de stabilité de 1976 à 1981, le nombre d'habitants a recommencé à augmenter pour s'arrêter au niveau actuel de 220.

Le tableau ci-dessous donne le coût annuel de chauffage au bois, au mazout et à l'électricité d'une maison typique de Cartwright et de Black Tickle:

	Cartwright	Black Tickle
Maison chauffée au mazout	1 952,35 $	4 280,00 $
Maison chauffée au bois (y compris les frais de main-d'oeuvre)	1 844,83 $	5 773,40 $
Maison chauffée au bois (à l'exclusion des frais de main-d'oeuvre)	683,23 $	3 050,68 $
Maison chauffée à l'électricité.	2 510,97 $	4 325,55 $

À partir de ce tableau, on peut conclure que même lorsqu'il faut se rendre à 10 km de Cartwright pour obtenir du bois de chauffage, il est encore plus économique d'utiliser ce combustible que de chauffer à l'électricité ou au mazout, même en tenant compte des frais de main-d'oeuvre de 4 $/heure. Si on ne tient pas compte des frais de main-d'oeuvre, il est possible d'économiser en moyenne 1 270 $ par année sur la facture annuelle en chauffant au bois plutôt qu'au mazout.

Étant donné que Black Tickle est plus éloigné des sources d'approvisionnement (42 km en moyenne), le chauffage au bois est la forme de chauffage la plus coûteuse si l'on prend en considération les frais de main-d'oeuvre de 4 $/heure. Lorsqu'on ne tient pas compte de la main-d'oeuvre, par contre, le chauffage au bois coûte environ 1 230 $ de moins par année que le mazout. Évidemment, à Black Tickle, les gens ne sont pas tellement récompensés de leurs efforts, mais ils n'ont peut-être pas le choix, étant donné les mauvaises conditions financières.

En moyenne, les habitants de Cartwright et de Black Tickle doivent débourser les sommes suivantes pour se procurer du bois de chauffage et entretenir leurs systèmes de chauffage au bois:

	Cartwright	Black Tickle
Coûts directs (essence et mazout)	36,54 $/corde	86,83 $/corde
Coûts indirects (réparations, entretien de la moto-neige, komatik, (traîneau), scie, vêtements, etc.))	41,10 $/corde	110,37 $/corde
Total partiel	77,64 $/corde	197,20 $/corde
Coût de la main-d'oeuvre (à 4 $/h)	132,00 $/corde	176,00 $/corde
Coût total	209,64 $/corde	373,20 $/corde

Nous avons découvert qu'il serait possible d'expédier f.a.b. du bois de chauffage de Goose Bay aux quais de Cartwright ou de Black Tickle pour environ 72 $/la corde. Ainsi, d'un point de vue strictement économique, il serait plus avantageux pour les habitants de ces collectivités d'importer leur bois de Goose Bay que de le couper eux-mêmes et de le transporter en traîneau (komatik).

2.2 Demande de combustible de chauffage dans les établissements commerciaux et publics

À Cartwright et à Black Tickle, les immeubles commerciaux et publics sont principalement chauffés au mazout (83 % de leurs besoins nets en énergie). La majorité des locaux de cette catégorie ne sont pas occupés 24 heures par jour ou leurs occupants sont des employés à temps complet qui n'ont pas le temps de s'occuper d'un système de chauffage au bois. Sans aide ou subvention gouvernementale, il est impossible de convertir ces immeubles au chauffage au bois.

2.3 Besoins en combustible des centrales électriques

À Cartwright et à Black Tickle, les plus grands consommateurs de combustibles à base de pétrole sont les centrales électriques, qui consomment respectivement 67 et 63 % de la totalité du mazout utilisé dans ces collectivités (quantité réelle à Cartwright: 630 430 litres et à Black Tickle: 339 790 litres).

La maison Acres Consulting Services Limited a fait une étude dernièrement sur la conversion au combustible biomassique des centrales alimentées au diesel, à Roddickton, à Main Brook et à Croque. Elle a ainsi constaté que seule la plus grande centrale, celle de Roddickton, se prêtait à la conversion. Étant donné que la quantité demandée d'électricité à Cartwright est inférieure au quart

de la demande d'énergie produite à partir du diesel à Roddickton et que la demande de Black Tickle est inférieure à la demande d'électricité de Main Brook, il ne serait pas rentable de convertir les centrales de Cartwright et de Black Tickle au bois sans subventions gouvernementales considérables.

3.0 Effets des subventions gouvernementales

Bien que les perspectives en matière d'augmentation de la consommation de bois de chauffage à Cartwright et à Black Tickle ne soient pas excellentes, il existe toutefois des moyens de promouvoir le remplacement du mazout par le bois. Ces initiatives, dont la mise en oeuvre devrait être subventionnée par le gouvernement, pourraient probablement s'autofinancer.

La plupart de ces subventions ne seraient pas rentables seulement au point de vue de remplacement du pétrole; en effet, comme elles devraient générer beaucoup d'emplois et avoir des retombées sociales dans ces régions, elles peuvent présenter de l'attrait pour le gouvernement au niveau socio-économique et au niveau de l'emploi.

3.1 Méthodes visant à augmenter la demande de bois de chauffage dans les résidences

La quantité demandée de bois de chauffage pourrait être accrue à Cartwright et à Black Tickle si le coût était abaissé et si l'approvisionnement était facilité. Cela nécessiterait toutefois une infrastructure et une organisation nouvelles. Pour ce qui est de l'infrastructure, il pourrait s'agir d'une route d'accès à la région de Cartwright et d'entrepôts de stockage du bois dans les deux collectivités, ce qui faciliterait la ramassage du bois pendant l'automne. Ces entrepôts serviraient également à stocker le bois amené de Goose Bay par bateau pendant les mois d'été.

Au point de vue de l'organisation, il faudrait commencer la construction des entrepôts et de la route d'accès et, autant que possible, donner l'exploitation des entrepôts au secteur privé. Si cela n'intéresse pas le secteur privé, les associations de développement pourraient s'en charger pendant un an, afin d'en démontrer la viabilité. Après cette période, les associations pourraient tenter d'en transférer la gestion au secteur privé par voie d'appels d'offres.

La construction, à Cartwright, d'un entrepôt pouvant stocker 1 150 cordes coûterait 35 000 $ et l'installation d'un entrepôt de 400 cordes à Black Tickle coûterait 25 000 $. Le coût de construction d'une route d'accès de 16 kilomètres vers Paradise River est évalué à 300 000 $. Les quais de Cartwright et de Black Tickle se prêtent au déchargement des cargaisons de bois de chauffage, particulièrement s'il s'agit de petites quantités d'environ 100 cordes par semaine transportées par les caboteurs réguliers.

3.2 Moyens d'augmenter la quantité de bois de chauffage demandée par les établissements publics et commerciaux

Avant d'espérer tout accroissement de la quantité demandée par les établissements commerciaux et publics, il faut mettre en place l'infrastructure et l'organisation mentionnées ci-dessus. Il faudra toutefois des mesures supplémentaires pour assurer la conversion du mazout au bois dans ces secteurs. Ainsi le gouvernement devra d'abord accorder des subventions pour couvrir une partie de la conversion, soit des subventions semblables à celles versées dans le cadre du Programme canadien de remplacement du pétrole. Puis il faudra établir un bureau d'approvisionnement en énergie qui fera l'entretien journalier des systèmes de chauffage, à contrat.

Cela ne peut se réaliser que s'il y a un nombre suffisant d'immeubles. Il est donc hors de question de prendre cette mesure à Black Tickle. Elle pourrait toutefois être appliquée à Cartwright, où la facture annuelle de chauffage dans ces deux secteurs atteint 75 000 $. Encore une fois, l'idéal serait que le bureau d'approvisionnement en énergie soit dirigé par une société privée. Toutefois, si aucune société ni particulier n'est intéressé à le faire, l'Association de développement pourrait se charger de la gestion pendant la première année et faire ensuite des appels d'offres portant également sur les entrepôts de stockage du bois.

3.3 Moyens d'augmenter la quantité demandée de bois des centrales électriques

La seule façon de convaincre la Newfoundland and Labrador Hydro d'alimenter sa centrale de Cartwright au bois plutôt qu'au mazout serait d'accorder des subventions gouvernementales suffisantes, dans le cadre de programmes de création d'emplois, pour rendre la chose réalisable. Comme les sources d'approvisionnement en bois sont rares dans la région de Black Tickle, il est très peu probable que la centrale soit alimentée au bois plutôt qu'au mazout. C'est à Cartwright que cette initiative offre le plus grand potentiel.

4.0 Conclusions et recommandations

Au point de vue strictement économique, il est moins coûteux de transporter le bois de Goose Bay que de le couper dans la région de Cartwright ou de Black Tickle. Pour favoriser le "remplacement du pétrole", il faudrait encourager le transport du bois de Goose Bay vers ces deux collectivités en construisant des entrepôts de stockage du bois près des quais. C'est la solution recommandée pour Black Tickle. Au point de vue socio-économique, il serait préférable pour la collectivité de Cartwright qu'elle ait accès à ses sources d'approvisionnement en bois directement par camion. Grâce à la construction d'une route d'accès de 16 kilomètres en direction de Paradise River, Cartwright pourrait avoir accès à des approvisionnements en bois suffisants pour répondre à ses besoins pendant les vingt prochaines années.

Idéalement, les entrepôts de bois de chauffage devraient être administrés et organisés par le secteur privé. L'Association de développement pourrait s'en charger au début, si c'est possible, et confier cette tâche au secteur privé après une période de rodage d'un an qui aura permis d'éliminer les difficultés de parcours et de démontrer la viabilité de l'entreprise. Pour promouvoir le remplacement du mazout par le bois dans les établissements publics et commerciaux, l'Association de développement pourrait créer un "bureau d'approvisionnement en énergie" qui, si cela était possible, serait géré par le secteur privé, tout comme les entrepôts de bois de chauffage. En apportant les modifications proposées à l'infrastructure et à l'organisation, il serait possible d'économiser environ 270 000 litres de pétrole par année.

Enfin, si la centrale était convertie au bois à l'aide de subventions gouvernementales, ces initiatives auraient d'importantes répercussions sur la collectivité de Cartwright. Ainsi, en supposant que le bois réponde à 75 % des besoins en énergie de la centrale de Cartwright, la consommation de mazout serait réduite d'une autre tranche de 470 000 litres par année à Cartwright.

Cette étude a été effectuée par Terpstra Engineering Limited pour le compte de l'Eagle River Development Association, à l'aide d'une contribution d'Énergie, Mines et Ressources Canada, accordée dans le cadre du Programme de démonstration dans les collectivités éloignées.

1. INTRODUCTION

1.1 Background

Over 300 remote communities in Canada have depended on oil products for their energy needs during the past decades. It is unlikely that many of them will be connected to the main electrical grids or natural gas networks in the future. Because of drastic increases in oil prices since 1973, oil may no longer be the best energy source. It is expensive and growing scarce. It must be brought in from great distances. Delivery is often difficult and subject to delay. Oil-based power generation may restrict the amount of electricity available for home, community and local industrial purposes. It also provides very little local employment in the remote communities which traditionally have very high unemployment.

1.2 Remote Community Demonstration Program (RCDP)

To help reduce dependence on oil, the Federal Department of Energy, Mines and Resources has established the Remote Community Demonstration Program. This Program is designed to help remote communities and agencies responsible for their energy supply to identify more appropriate energy alternatives and energy conservation opportunities. To do this, the Program offers limited financial assistance for carrying out studies to explore these alternatives and opportunities. This is the first phase of the Program, that will expire on March 31, 1985. In a second phase of this Program, it will contribute funds to a limited number of demonstration projects in selected remote communities across Canada. It will then transfer the knowledge gained from funded studies and projects to all communities and agencies where this knowledge is needed.

The Program aims to help communities achieve greater energy self-reliance, lower long-term energy costs and, in some cases, increase levels of electrical service for home, community and local industrial needs.

In order to assist in the operation and future planning of this Program in the Province of Newfoundland, the Newfoundland Regional Office of Energy, Mines and Resources Canada carried out an overview study (Remote Community Demonstration Program - Newfoundland Region - Overview Study, by Brador Resource Management Limited and BFL Consultants Limited), to identify and profile remote communities in Newfoundland and Labrador which are eligible for the Program, and to identify alternative energy sources and energy conservation options open to these communities.

Two of the eligible communities, identified in the overview study, Cartwright and Black Tickle, both on the East Coast of Labrador, will be investigated in more detail in this "Biomass Study for Cartwright, Labrador".

1.3 Objective

This study is being carried out to assess the potential to increase the use of biomass fuel in the communities of Cartwright and Black Tickle. This will be done in the following ways:

1.3.1 The study will determine the current level of wood fuel usage, estimate the potential to increase this usage and determine the availability of the resource to meet current and future demands.

1.3.2 The study will establish the feasibility of supplying wood to Black Tickle from the resource located in the Cartwright area.

1.3.3 Finally, the study will address the social and economic justification for establishing the necessary infrastructure required to increase the level of wood usage in both Cartwright and Black Tickle.

A more detailed "Scope of Work" is included in the Work Statement, attached as Appendix "A".

1.4 Methodology

To prevent duplication of effort, the study will draw heavily on available information from the following sources and agencies:

- Remote Community Demonstration Program - Newfoundland Region - Overview Study.
- Department of Mines and Energy.
- Department of Forest Resources and Lands.
- Energy, Mines and Resources Canada.
- Statistics Canada.
- Newfoundland Statistics Agency.
- Newfoundland and Labrador Hydro.

Information on current consumption levels for light fuel oil, stove oil, electricity and wood will be determined primarily from householder surveys, and double checked with the suppliers and wholesalers records. All occupied buildings in both communities will be surveyed by means of personal interviews, with the owners or occupants during which a questionnaire will be filled out. A sample of the questionnaire is attached as Appendix "B". Some of the questions will ask for homeowner input on how wood consumption could be increased, and oil consumption reduced. Other interviews will be held with representatives of the Eagle River Development Association, Community Council, Employment Canada, etc. to determine how this study fits in the overall development objectives for the area.

Finally, conclusions will be drawn from all collected data to determine how the goals of this study can be achieved, and what the social and economic impacts will be.

2. TECHNICAL AND ECONOMIC DISCUSSION

2.1 Community Data on Cartwright

Cartwright is located on Sandwich Bay, in Coastal Labrador, approximately 230 km by air east of Goose Bay. It was incorporated as a municipal body in 1956 and has had the following population growth (Statistics Canada):

1951 - 244 persons.
1956 - 359 persons.
1961 - 493 persons.
1966 - 616 persons.
1971 - 752 persons.
1976 - 675 persons.
1981 - 658 persons.
1985 - 579 persons. (Our survey extrapolated for the five homes who refused to cooperate).

This table shows a peak of population in 1971 and a steady decline since then. The latest (1981) census data of Statistics Canada revealed that there were 165 occupied private dwellings, and 165 private households, with an average of 4.0 persons per private household. Our January 1985 door-to-door survey revealed that there were 157 occupied private dwellings, 6 commercial buildings and 12 institutional and government buildings heated and in use at that time, for a total of 175 buildings. We had a total of 169 completed questionnaires and 6 uncompleted questionnaires, because the homeowners did not want to cooperate with the survey, a response rate of 97%. Where applicable, we have extrapolated our survey data to get 100% representation. It should be noted that most of the people who did want to participate in the study, live in Federal Government housing, whereby heat and lights are provided by the government at no expense to the homeowner. Under those circumstances, it is understandable that the occupant was not interested in any study that might affect his current status. It seems a little ironic however, that the same government that tries to encourage off-oil conversion, and tries to increase local employment levels, has all its own houses in Cartwright heated with oil, without any incentive for the government employees to conserve or convert to wood.

Questions 3 and 4 further showed that there were 383 adults and 196 children in the 157 residences for an average of 3.7 persons per residence. Question 5 showed that 142 or 90% of the residences had at least one person of 16 years and over who was physically able to cut firewood, with a total of 208 persons physically fit to get firewood. Question 6 asked if the persons who are physically able to get firewood, are employed or not. This would make it impractical for them to get firewood. This left 116 or 74% of the residences with at least one physically able, normally unemployed person that could get firewood, and 41 homes or 26% that had nobody who had time or was able to get firewood. This is an important statistic that could limit the potential for increased wood usage on an individual basis. We will refer to this later on. Questions 7 to 10 relate directly to the size of the buildings and the insulation thicknesses. The average size house had 77.4 m^2 of floorspace (833 sq. ft.). It was staggering to see how many buildings had inadequate insulation levels, compared to currently recommended levels. Many dwellings had no basements, but just a crawlspace, but only 27 of these had any insulation in the basement or crawlspace at all with an average thickness of 100 mm. The overall average thickness for the

whole community was 18 mm. Average insulation thickness in the walls for the whole community was 82 mm and in the attics, it was 80 mm. Almost all insulation was fibreglass batt insulation, which therefore converts into the insulating values, tabulated below for the total wall or ceiling construction (Table 1). In the same table, we have also shown the recommended minimum thermal resistance values for new homes for this climatic region (6543 degree days based on 18°C). This information is based on CGSB 51-GP-42 MP, table 3.3:

TABLE 1

	Existing in Cartwright	Recommended Minimum for New Homes in Cartwright
Wall assemblies above ground level	2.3	3.7
Foundation wall assemblies	0.8	2.1
Roof or ceiling assemblies	2.0	7.1

From this table can be seen that there is much room for improvement of the insulating values of the houses. Visual observations further indicated considerable heat losses through air leakage, particularly in the older homes. The 1981 Census data provided by Statistics Canada indicated the following age classification of the occupied private dwellings in Cartwright:

Period of Construction	Number
1920 or before	5
1921 - 1945	25
1946 - 1960	45
1961 - 1970	50
1971 - 1975	20
1976 - 1979	10
1980	0
1981	5
Total	160*

So, one conclusion of our door-to-door survey is that the energy requirements of the community of Cartwright could be reduced considerably by means of better insulating the buildings, and making them more airtight. Although this is not part of our terms of reference, various energy conservation options are strongly supported by other government programs (CHIP for example). It is recommended that under the RCDP's second phase, a big effort is made to make this kind of recommendations available to the people in the remote communities.

2.2 Labour Force Activity in Cartwright

A study of the labour force data provided by Statistics Canada based on the 1981 Census was very depressing. With a male population of 15 years and older of 255, only 95 were in the labour force, of which 55 were employed and 45 were unemployed*. This results in a participation rate of only 37.3% and an unemployment rate of 47.4% (Statistics Canada, Table 1). The female population of 15 years and over was 215 and only 55 of these were in the labour force, 40 employed and 15 unemployed. This results in a participation rate of 25.6% and an unemployment rate of 27.3%.

*Some Census data from Statistics Canada do not add up, due to rounding.

The statistics further showed that the highest unemployment is in the 15 - 24 age group. The average employment income for persons over 15 years in Cartwright was $9,115.00 for men and $4,355.00 for women in 1980. Average private household income was $17,645.00.

Because most employment in Cartwright is in the fishery, which is limited to the June - October period, and the heating season normally runs from September to June, any additional employment created to provide firewood, should not negatively affect employment in the fisheries sector. To the contrary: in general, it can be said that except for the people employed by government, in stores, in the hospital, the school, the post office, and the power plant, most other people in the Community are unemployed most of the fall, all winter and all spring, and are therefore available to get their own firewood or work at a community wood supply operation.

2.3 Energy Analysis for Cartwright

The 1981 Statistics Canada classifications of occupied private dwellings by main type of heating equipment for Cartwright was not very helpful for this study. Of the 165 occupied private dwellings in 1981, the division was as follows:

Steam or hot water furnace	Nil
Hot air furnace	30
Installed electric heating system	Nil
Stove or space heater	90
Other	40
Total	160

This total does not match the listed number of 165 occupied private dwellings. It was based on a 20% sample, and the difference is a result of random rounding to units of five, according to Statistics Canada representatives.

Our own 1985 door-to-door survey gave more suitable and up-to-date results for the purpose of this study. Questions 11 to 16 dealt directly with the type of heating system used in each building and the annual cost of each individual energy source. Our terms of reference called for a breakdown by building type (residential, commercial or institutional) and energy source used as heating fuel (light fuel oil, stove oil, electricity and wood). We included the Hydro plant as a separate sector and it should be noted that all electricity listed as heating fuel is generated in the power plant from oil and is therefore included twice in the following tables. The churches, RCMP office, Coast Guard office, Community Hall, Library and Weather Station are all grouped under the institutional sector. Small scale hydro, peat, and wind energy, heat recovery, co-generation and district heating are presently not used as energy source in Cartwright. It should be pointed out that furnace oil is not shipped to the Labrador Coast, but that instead, a multipurpose Arctic #1 fuel is supplied with a $-50^{o}C$ pourpoint. This is very similar to stove oil and also used in all diesel engines on the Coast (e.g. fishing boats, generators, etc.).

Based on questions 2 and 11 of our January 1985 survey, the following distributions by building type and heating source were found. Table 2 expresses this in number of buildings and percentages:

TABLE 2

1985 Energy Profile in Number of Buildings

Building Type	(1)Oil	(2)Wood	(3)Electricity for heating only	(1)and(2)	(1)and(3)	(2)and(3)	(1)(2)(3)
Residential	21(13.4%)	108(68.8%)	-	24(15.3%)	1(0.6%)	2(1.3%)	1(0.6%)
Commercial	4(80.0%)	-	-	1(20.0%)	-	-	-
Institutional	6(50.0%)	-	-	5(41.7%)	1(8.3%)	-	-
Hydro Plant	-	-	1(100%)	-	-	-	-
Total	31	108	1	30	2	2	1

Table 3 shows the heating profile by building type in actual quantities used (wood in sticks, oil in imperial gallons, electricity in KWh). This table is based on the answers of questions 12 to 16. Electric heat figures were calculated by multiplying heater ratings with estimated hours of use. Information available from Newfoundland Hydro did not show electricity used for heating purposes separately:

TABLE 3

1985 Energy Profile (In Locally Used Units)

Building Type	Stove Oil (in Imperial Gallons)	Wood (in number of sticks)	Electricity (in KWh)
Residential	34,430	112,730	13,216
Commercial	5,213	1,000	108
Institutional	28,606	400	35,100
Hydro Plant	138,800	-	17,136
Total	207,049	114,130	65,560

Table 4 converts these figures into one unit, the gigajoule (GJ) to facilitate comparison. It does not take into account the heating effeciency of the different stoves. Conversion factors used are:

1 KWh = 0.0036 GJ.
1 Imperial Gallon of stove oil = 4.542 litres = 0.1711 GJ.
100 Sticks of Wood = 18.50 GJ. (See Appendix "C").

TABLE 4

1985 Gross Energy Profile (In Gigajoules)

Building Type	Oil	Wood	Electricity	Total
Residential	5,891	20,855	48	26,794
Commercial	892	185	-	1,077
Institutional	4,894	74	126	5,094
Hydro Plant	23,749	-	62	23,811
Total	35,426	21,114	236	56,776

In Table 5 these figures are converted to net energy needed, by taking into account the efficiency of the various heating systems. We assume that electric heat has 100% efficiency, oil heat has 60% efficiency, and wood heat has 50% efficiency. Because many of the homes have old fashioned type wood stoves, energy needs can be reduced considerably by using the more modern "airtight" woodstoves, which can achieve efficiencies of 75%.

TABLE 5

1985 Net Energy Profile (In Gigajoules)

Building Type	Oil	Wood	Electricity	Total
Residential	3,535 (25%)	10,428 (75%)	48 (0%)	14,011 (100%)
Commercial	535 (85%)	92 (15%)	-	627 (100%)
Institutional	2,936 (95%)	37 (1%)	126 (4%)	3,099 (100%)
Hydro Plant	14,249 (100%)	-	62 (0%)	14,311 (100%)
Total	21,255 (66%)	10,577 (33%)	236 (1%)	32,048 (100%)

2.4 Electrical Consumption Analysis for Cartwright

Newfoundland and Labrador Hydro provided the following information for Cartwright:

TABLE 6

Rate	Description	No. of Customers	Demand
1.2	Domestic Diesel	195	938,335 KWh
2.2 A	General Service Hydro, 10 - 100 KW (Fishplant receives special rate)	1	57,600
2.5	General Service Diesel 0 - 10 KW	33	235,626
2.5	General Service Diesel 10 - 100 KW	4	238,740
5.6	Street and Area Lighting Service	8	15,354
Total		241	1,515,655 KWh

The charges for the Domestic Diesel rate are as follows:

Basic Customer Charge	$ 9.50
First 500 KWh per month @ (Subject to fuel adjustment clause)	4.72 cent per KWh
Next 500 KWh per month @	8.83 cent per KWh
All KWh over 1000 KWh per month @	11.98 cent per KWh
Minimum monthly charge	$ 9.50

The charges for the General Service Diesel rate are:

All KWh @ (Not subject to fuel adjustment clause)	17.84 cent per KWh
Minimum monthly charge	$14.44

The electric heating demand tabulated in Section 2.3 of this report is included in the above overall consumption figures.

We have also investigated the cost to heat a typical house in Cartwright with electricity only. The total net residential heating demand for 157 homes is 14,011 GJ (Table 5), or 89,242 GJ/home average. With 100% seasonal efficiency and a conversion factor of 1 KWh = 0.0036 GJ., this results in an average electric heating consumption of 24,789 KWh/year. Based on the 40 year mean degree days for Goose Bay for the different months, the total consumption can be broken down as follows, assuming Cartwright is similar to Goose Bay in that aspect:

TABLE 7

Month	Degree Days	%	Total KWh	Basic Rate	First 500 KWh @ 4.72¢	500 - 1000 KWh @ 8.83¢	Over 1000 KWh @ 11.98¢	Total Cost
Jan.	1,114.6	16.2	4,016	9.50	23.60	44.15	361.32	$438.57
Feb.	962.3	14.0	3,470	9.50	23.60	44.15	295.91	373.16
March	855.8	12.5	3,099	9.50	23.60	44.15	251.46	328.71
April	608.0	8.9	2,206	9.50	23.60	44.15	144.48	221.73
May	405.4	5.9	1,463	9.50	23.60	44.15	55.47	132.72
June	209.5	3.0	744	9.50	23.60	21.55	-	54.65
July	89.3	1.3	322	9.50	15.20	-	-	24.70
Aug.	141.8	2.1	521	9.50	23.60	1.85	-	34.95
Sept.	293.3	4.3	1,066	9.50	23.60	44.15	7.91	85.16
Oct.	499.1	7.3	1,809	9.50	23.60	44.15	96.92	174.17
Nov.	669.7	9.7	2,404	9.50	23.60	44.15	168.20	245.45
Dec.	1,014.5	14.8	3,669	9.50	23.60	44.15	319.75	397.00
Total	6,863.3	100.0	24,789	114.00	274.80	420.75	1,701.42	$2,510.97

Please note that this does not include the fuel adjustment premium.

2.5 Analysis of Wood Heating Cost for Cartwright

Questions 17 to 22 were asked to determine the true cost to obtain firewood and look after a wood stove or wood furnace.

The cost per cord, or per 100 sticks has been calculated in three parts, the labour component, the direct and the indirect expense component. By multiplying the answers of questions 17 and 18, the total number of hours was calculated, that was spent on getting the amount of firewood that was listed as answer to question 13. This was expressed as number of hours spent per 100 sticks of wood (or per cord of wood).

The value of the time spent on getting firewood could be rated in many different ways. One train of thought would be that most people get their Unemployment Insurance, while they get their firewood, and would traditionally go into the woods anyway, more or less as a hobby or to keep occupied and fit. With this philosophy, the hourly rate would be nil. On the other extreme, cutting firewood in deep snow conditions is no pleasure and extremely hard, uncomfortable and hazardous work that would normally require about $8 - $10 per hour to get people to do it as an occupation, unless they were desperately in need of employment. (Not enough stamps to qualify for UIC benefits).

We will base our cost analysis on a happy medium, the minimum wage, i.e. $4 per hour. Based on this, the average labour cost per 100 sticks or per cord of firewood is $132.00. The average productivity was only 3 sticks per manhour, surprisingly low at first glance, but when one considers that the people won't see any direct monetary reward, and have very little else to do, it makes sense that they "take their time". The only other explanation for this low productivity is if they exaggerated the time spent on getting wood, when they replied to our questionnaire.

The cost of direct expenses such as gas and oil has been calculated from the answers of questions 19 and 20. This resulted in an average fuel cost of $5.46 per trip or $36.54 per 100 sticks or per cord. A total of 15,600 Igals of fuel was burned to obtain the total amount of fuelwood for the community.

The cost of indirect expenses such as repairs and maintenance of skidoo and chainsaw, and other related expenses such as torn clothing, snowshoes, damaged komatics, lost axes, ropes, etc., was obtained from the answers of questions 21 and 22. The average cost was $41.10 per 100 sticks or per cord, or $358.11 per house. The total cost per 100 sticks was then obtained by adding the labour, direct and indirect costs. This averaged out at $132.00 + $36.54 + $41.10 = $209.64 per 100 sticks. It was also compared with the distance to get to wood supply on an individual basis in the attached graph (Graph #1 and Map #1).

From this graph the following conclusions could be drawn, after the initial 3 mile point was reached, the total cost increased linearly with the distance at approximately $18 per mile. The 9 and 11 mile points are far off the average due to the small sample (2 and 1 homeowners respectively). We also calculated a total annual wood heating cost per home, based on the annual amount of wood used (question 13). For homes with only wood as source of energy, the average annual cost was $1,844.83. This is slightly less than the average annual cost of homes heated exclusively with oil ($1,952.35) and considerably less than the theoretical cost of all electric homes ($2,510.97).

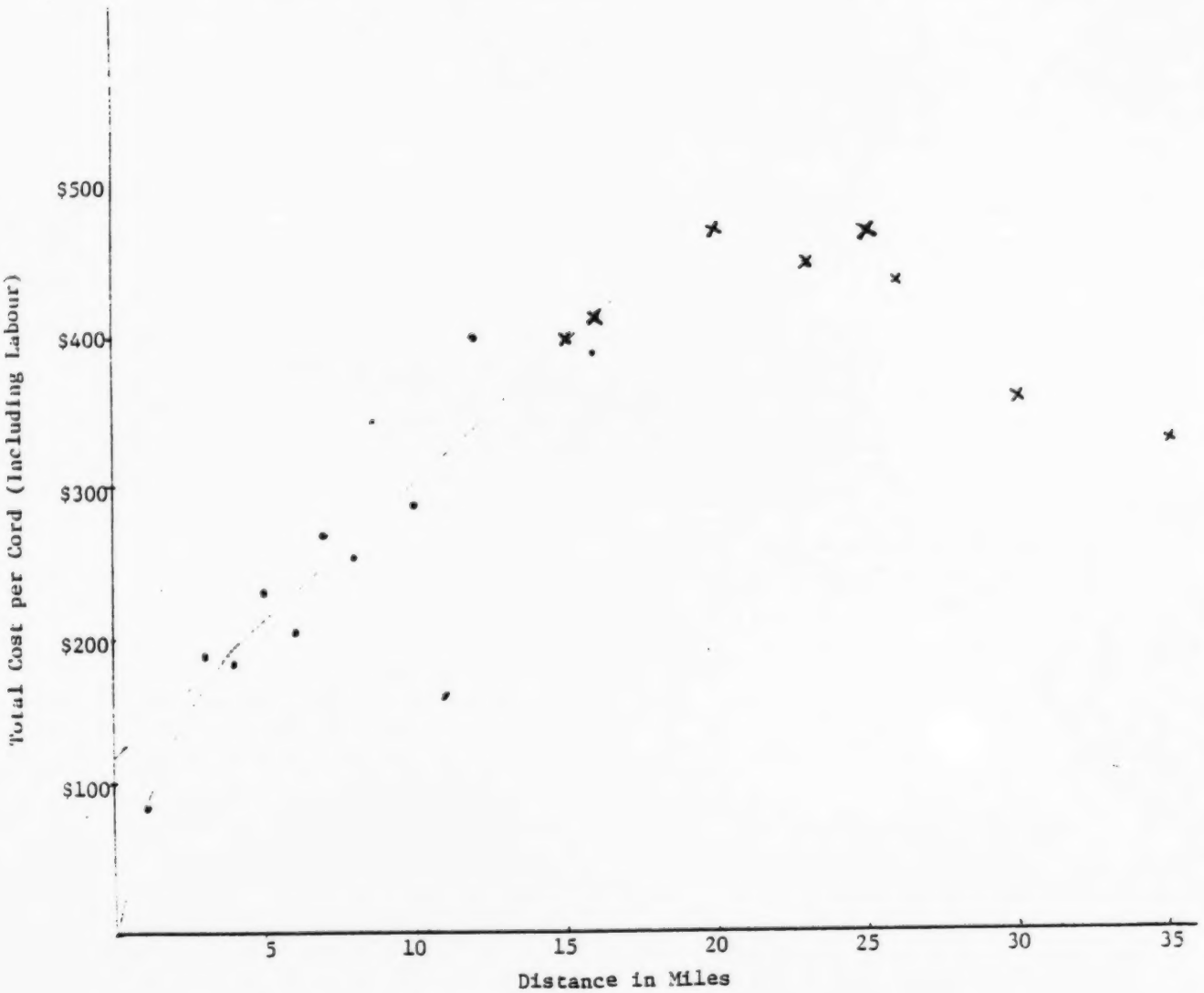
When the cost of wood heating is calculated, without taking into account the cost of labour, the annual cost is $77.64 + $209.64 x $1,844.83 = $683.23. This is obviously the reason why so many people burn wood in Cartwright. They can save themselves $1,844.83 - $683.23 = $1,161.60, say $1,150.00 per year by providing their own fuel.

Our findings for oil-heated homes were compared with a 1984 report prepared by the Newfoundland Statistics Agency, entitled "Annual Cost of Fuel and Utilities, Newfoundland and Labrador". It found that based on degree days, the estimated annual consumption of furnace oil was 4730 litres at a cost of 50.1 cents per litre. This resulted in an estimated annual cost of $2,370.00 for Coastal Labrador communities. Of the 17 houses with exclusive oil heating we surveyed, we found an average consumption of 3874 litres.

Another way to determine the value of firewood in Coastal Labrador to the different users, was by asking them what they would be willing to pay for 100 sticks of wood. This was asked in question 25, and the average price quoted was $88.92 per 100 sticks. The going price for firewood was $75.00 - $100.00 per 100 sticks depending on the size of the wood, during the time of our field survey. This is considerably lower than the above calculated actual cost of $209.64 taking labour into account. It is only slightly higher than the above calculated direct and indirect cost ($77.64 per 100 sticks), excluding labour.

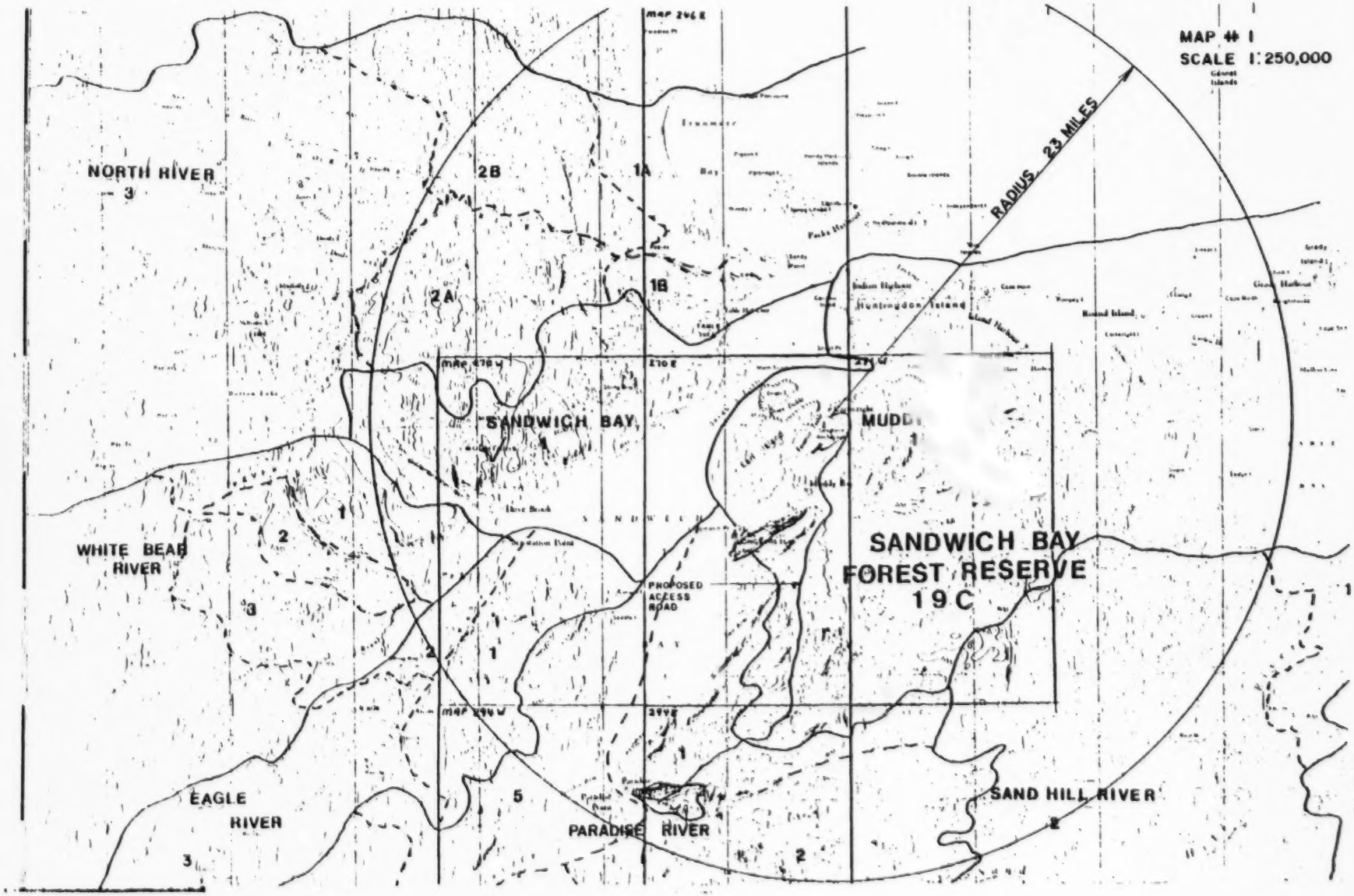
GRAPH 1

Cost - Distance Relationship for Getting Firewood



• Cartwright survey results.

× Black Tickle survey results.


MAP # 1
SCALE 1:250,000
RADIUS 23 MILES
NORTH RIVER
3
2B
1A
2A
1B
SANDWICH BAY
MUDD
WHITE BEAR
RIVER
SANDWICH BAY
FOREST RESERVE
19 C
PROPOSED
ACCESS
ROAD
EAGLE
RIVER
PARADISE RIVER
SAND HILL RIVER

Either the people never realized what it actually cost them per cord to get firewood, taking into account all labour, direct and indirect costs, or the other explanation could be that they get their own firewood for pleasure or to keep fit or to justify and pay for the ownership of a skidoo. Although frequently the skidoo is a necessity in Coastal Labrador, it is also the most popular toy for young and old, and the only means of local transportation for 6 - 7 months of the year. Obviously, the few people who cut firewood for sale to others, received very poor returns for their efforts.

To get an idea of the frequency of accidents resulting from burning wood, we asked in question 24 how many accidents the homeowners had in the past year, such as:

Health problems (bad backs, etc.):	9% said yes.
Skidoo damage:	15% said yes.
Komatic damage:	31% said yes.
Chainsaw accidents:	3% said yes.
House fires:	0% said yes.

From the initial conversations in Cartwright, before the Questionnaire was formulated, it appeared that many people had already switched from oil to wood. We therefore asked in question 26, when people changed from oil to wood. The results were as follows:

Before 1974:	70% (including those who always burned wood).
In 1974:	1%
In 1975:	2%
In 1976:	1%
In 1977:	Nil
In 1978:	2%
In 1979:	2%
In 1980:	5%
In 1981:	2%
In 1982:	4%
In 1983:	2%
In 1984:	8%
In 1985:	1%

This clearly indicated that most people in Cartwright always burned wood, and that only in 1984 a substantial number switched over to wood, probably as a result of the COSP program which started October 28, 1980.

The final two questions of the questionnaire ask the homeowner what would make them burn more wood and leave room for comments by the interviewer. Generally, the main conclusion is that if wood could be made more readily available to the community, people would use more wood and/or convert from oil to wood.

One of the suggestions made frequently was that if an access road was made in the general direction of Paradise River, wood could be brought out more economically by truck over longer distances. There are 16 trucks in Cartwright at the moment, 15 pickup trucks and one 20 ton dumptruck. In conclusion, it can be said that many homeowners already burn wood and that with the ever increasing distances to get firewood, it is not likely that many more will convert from oil to wood.

To the contrary, as it will become harder and harder to get firewood close by, it is anticipated that the switch from oil to wood will be reversed, unless some action is taken to make wood more readily available.

2.6 Community Data on Black Tickle

Black Tickle and Domino are located on Island of Ponds, off the Coast of Labrador, approximately 310 km by air, east of Goose Bay and 86 km by air east of Cartwright. They were established as one local service district council in 1981 and have had the following population growth:

1935 - 50 persons (including 10 in nearby Salmon Bight).
1945 - 59 persons.
1951 - 23 persons.
1956 - 73 persons.
1961 - 76 persons (including 46 in nearby Salmon Bight).
1966 - 106 persons.
1971 - 164 persons.
1976 - 194 persons.
1981 - 194 persons.
Jan 1985 - 219 persons (including 16 in nearby Domino and 3 in Penny Hook Cove).

The data up to 1981 was obtained from Statistics Canada, the January 1985 data from our door-to-door survey, supplemented by information from the Grenfell Regional Health Services (GRHS). This table shows a stability of the population from 1976 - 1981 and a 13% growth from 1981 to 1985.

Under the terms of reference of the Remote Community Demonstration Program, eligible communities must have no less than ten occupied principal residences and therefore Domino with four and Penny Hook Cove with one residence were considered not eligible in the Overview Study. We have included them in our study, because:

(i) They are part of the same Community Service District Council and as such form one "Community".

(ii) They are located so close to Black Tickle (1.5 km) and experience the same difficulties in obtaining firewood, that they would benefit from and utilize any improvements made for Black Tickle.

Based on our door-to-door survey, there were 39 occupied private dwellings in Black Tickle, four in Domino and one in Penny Hook Cove, for a total of 44 occupied residences. (42 in 1981 according to Statistics Canada Census data).

From Grenfell Regional Health Services records, we learned that an additional four families moved out of Black Tickle for this winter and only spend their summers. Some other families had moved in together into one house for the winter. We counted three commercial buildings in use in January 1985, such as the powerplant, Fishplant, 1 store and 3 institutional Buildings actually in use, such as the School, the Church, and the Clinic. The Fish Plant, a large consumer of electricity in the summer months was not in use, other than for a heated storage shed during our survey. The new clinic was not yet operational at that

time due to mechanical problems. Our door-to-door survey resulted in completed questionnaires from 34 out of 39 homes in Black Tickle, all four homes in Domino, all three commercial and all three institutional buildings, which gives a coverage rate of 88%.

The Census data for Black Tickle was not readily available because, due to its small size, Black Tickle was grouped together with Paradise River, quite a distance away. In 1981, Black Tickle had a population of 194 out of 299 in the Enumeration Area, or 65%. We will therefore only use the Census data only to give some general idea about income and employment levels, assuming that the percentages are the same in both communities.

Our own and the GRHS survey indicated that there were 219 residents in Black Tickle and Domino, of which 123 were 18 or over and 96 under 18. On the average, there were 5.0 persons per private household in 1985, slightly higher than the 4.6 listed in the 1981 Census. This is probably a result of people moving in together to save on heating costs.

Question 5 of our survey asked the number of people in each home who were 16 or over and were physically able to get firewood. Question 6 asked if they were normally employed during the winter months. The results of the survey were that of the 38 homes surveyed, a total of 31 or 82% had at least one person physically capable to get firewood. When the people who are normally employed during the winter months, and who therefore practically don't have time to get their own firewood are eliminated, there are 27 homes out of 38 or 71% left with at least one person, who is in technically available to get firewood. In Cartwright, this percentage was 74%.

Questions 7 to 11 related directly to the construction of the houses and the heating systems used. The average floor space in Black Tickle was 94 m^2 per house, and the average insulation thickness in basement or crawlspace walls, exterior walls or ceilings was respectively 26, 74 or 77 mm. When this is converted to thermal insulation values of the complete walls or ceilings, and compared with currently recommended levels for new homes, it can be seen that many improvements can be made to the homes to make them more energy efficient. See Table 8 below:

TABLE 8

Thermal Resistance (RSI) Value, m^2 $^oC/W$

	Existing in Black Tickle	Recommended Minimum for New Homes in Black Tickle
Wall assemblies above ground level	2.1	3.7
Foundation wall assemblies	1.0	2.1
Roof or ceiling assemblies	2.0	7.1

These results are very similar to those for Cartwright. Visual observations further indicated considerable heat losses through air leakage, particularly in the older homes. The 1981 Census data for Enumeration Area 203 (Black Tickle and Paradise River) revealed that 60% of the homes needs regular maintenance, 20% minor repairs and 20% major repairs, and that the bulk of the homes (60%) were constructed between 1971 - 1979.

2.7 Labour Force Activity in Black Tickle

The labour force statistics of the 1981 Census for Black Tickle and Paradise River were equally depressing as those for Cartwright. Because Paradise River is grouped in with Black Tickle, only percentages will be used, rather than absolute numbers. In 1981, in the Enumeration Area, 57.5% of the population of 15 years and over were considered participants in the labour force (71.4% of the men and 47.4% of the women) and 34.8% were considered unemployed (40% for the men and 22.2% for the women). The average employment income in 1980 in Black Tickle and Paradise River was $6,784 per person for both sexes ($7,514 for men and $5,432 for women). For comparison, in Cartwright, the figures were $9,115 for men, and $4,355 for women.

Similar to Cartwright, the sole economic base of Black Tickle is the fishery, which is limited to the June - October period. Any jobs created in the off-season to supply firewood to the individual homes or to the community as a whole would therefore not pose any conflicts with the fishery.

2.8 Energy Analysis for Black Tickle

The 1981 Statistics Canada classification of occupied private dwellings by main type of heating system did not provide us with any useful information for the purpose of this study. It just showed for the Black Tickle - Paradise River area that 69% of the occupied private dwellings were heated by stove or space heater, 23% by hot air heating system and 8% by other forms. A fuel cost survey carried out by the Newfoundland Statistics Agency provided some average heating cost figures for Coastal Labrador based on theoretical degree days and fuel costs. Our 1985 door-to-door survey aimed to get a current picture on what people used as heating fuel and how much of each type of fuel was used in each house.

Although the figures used in our survey are based on information supplied to us by the homeowner, sometimes backed up by receipts of oil bills, etc., it should be pointed out that there could be errors in the estimates each homeowner made. Fortunately, they did not stand to benefit of unrealistically high or low estimates, so we therefore believe that our survey results are fairly reliable, when they are averaged.

Questions 11 to 16 dealt directly with the type of heating system used in each building and the annual cost of each individual energy source. Our terms of reference called for two breakdowns, one by building type and one by heating fuel. We also had to classify all occupied buildings into the following types: residential, commercial and institutional. For clarification, we have considered the Hydro Plant a separate category, and the Clinic, as an institutional building. The new clinic which was not yet operational, was not included in our survey. The energy categories we had to use were light fuel oil, stove oil, electricity and wood. Furnace oil is not available on the Labrador Coast, and the same fuel is used for diesel motors as for home heating. Small scale hydro, peat and wind energy, heat recovery, co-generation and district heating are presently not used as energy source in Black Tickle, although the last three have potential for the fishplant, the largest electricity user, which is located adjacent to the powerplant.

Based on questions 2 and 11 of our January 1985 survey the following distributions by building type and energy source were found (Table 9). Our figures have been extrapolated to include the six houses that refused to cooperate with our survey.

TABLE 9

1985 Energy Profile (Expressed in Number of Buildings)

Building Type	(1)Oil	(2)Wood	(3)Electricity	(1)and(2)	(1)and(3)	(2)and(3)	(1)(2)(3)
Residential	12(26%)	18(40%)	1(3%)	8(18%)	2(5%)	1(3%)	2(5%)
Commercial	-	-	1(50%)	-	1(50%)	-	-
Institutional	1(33%)	-	1(34%)	-	1(33%)	-	-
Power Plant	-	-	-	-	1(100%)	-	-
Totals	13	18	3	8	4	1	2

Table 10 shows the energy use by building type in actual quantities used or estimated (wood in sticks, oil in Imperial Gallons, electricity in KWh). This table is based on the answers of questions 12 to 16.

TABLE 10

1985 Energy Profile (in Locally used Units)

Building Type	Oil (in Imperial Gallons)	Wood (in number of sticks)	Electricity (in KWh)
Residential	33,135	31,700	13,875
Commercial	1,500	-	23,199
Institutional	8,897	-	50,675
Power Plant	74,811	-	9,750
Totals	118,343	31,700	97,499

The people who heated their homes exclusively with wood burned an average of 1547 sticks, 75% more than in Cartwright. This could be a result of smaller wood in the Black Tickle area. The total residential oil consumption, based on the survey results was 33,135 Igallons or an average of 1,712 Igallons per house with exclusive oil heat @ 2.50/gallon = $4,280.00. These figures don't match the results of the Newfoundland Statistics Agency (1,041 Igal/house), nor do they match the figure of 8,000 - 9,000 Imperial Gallons of stove oil sold by the local merchant during the winter months. We are aware of bulk purchases by the R.C. Schoolboard for their houses of 5,400 Igals and from one individual who bought approximately 400 gallons from a Newfoundland fisherman, when the fisherman returned to Newfoundland, but this still only accounts for a total oil consumption of 15,000 Igallons, less than 50% of the reported figure. We therefore suspect that our oil consumption figures are exaggerated by the residents of Black Tickle, to emphasize their plight.

In Table 11, the above figures are converted into one unit, the gigajoule (GJ), to facilitate comparison. The following conversion factors were used, similar as was done with the Cartwright statistics:

1 KWh = 0.0036 GJ.
1 Imperial Gallon of Stove Oil = 4.542 litres = 0.1711 GJ.
100 Sticks of Wood = 1 Cord = 18.50 GJ (See Appendix "C").

This does not take into account the seasonal efficiency of the various heating systems.

TABLE 11

1985 Gross Energy Profile (in Gigajoules)

Building Type	Oil	Wood	Electricity	Total
Residential	5,669	5,865	50	11,584
Commercial	257	-	84	341
Institutional	1,522	-	182	1,704
Power Plant	12,800	5,865	35	12,835
Totals	20,248	5,865	351	26,464

In Table 12, the above figures are converted into net usuable energy, by introducing the seasonals efficiency of the various heating systems. We assume the following efficiency coefficients:

Electricity:	100%
Oil stove or heater:	60%
Wood stove or heater:	50%

Again, as pointed out in Section 2.3, the efficiency of modern "airtight" woodstoves can be as high as 75%, but most woodstoves were not that type. So, considerable reductions in the wood demand can be made by converting to more efficient stoves.

TABLE 12

1985 Net Energy Profile (in Gigajoules)

Building Type	Oil	Wood	Electricity	Total
Residential	3,401 (53%)	2,933 (46%)	50 (1%)	6,384 (100%)
Commercial	154 (65%)	-	84 (35%)	238 (100%)
Institutional	913 (83%)	-	182 (17%)	1,095 (100%)
Power Plant	7,680 (100%)	-	35 (0%)	7,715 (100%)
Totals	12,149 (79%)	2,933 (19%)	351 (2%)	15,433 (100%)

2.9 Electrical Consumption Analysis for Black Tickle

Newfoundland and Labrador Hydro provided the following information for Black Tickle:

TABLE 13

Rate	Description	No. of Customers	Demand
1.2	Domestic Diesel	46	433,123 KWh
2.2 A	General Service Hydro, 10 - 100 KW	1	39,360
	100 - 350 KW	Same	68,160
	(Fishplant receives special rate)		
2.5	General Service Diesel 0 - 10 KW	9	151,495
Total		56	692,138 KWh

The charges for the Domestic Diesel rate are as follows:

Basic Customer Charge	$ 9.50
First 500 KWh per month @ (Subject to fuel adjustment clause)	4.72 cent per KWh
Next 500 KWh per month @	8.83 cent per KWh
All KWh over 1000 KWh per month @	11.98 cent per KWh
Minimum monthly charge	$ 9.50

The charges for the General Service Diesel rate are:

All KWh @ (Not subject to fuel adjustment clause)	$17.84 cent per KWh
Minimum monthly charge	$14.44

The electric heating demand tabulated in Table 10 of this report (97,499 KWh) is included in the above overall consumption figures, and constitutes approximately 14% of the total demand.

The cost to heat a typical house in Black Tickle electrically can be calculated as follows:

The total net heating requirement of 44 homes in Black Tickle is 6384 GJ (Table 12). This gives an average of 145.1 GJ/house/year ÷ 0.0036 = 40,303 KWh per year, based on 100% seasonal efficiency. This is considerably higher than the annual demand in Cartwright, probably due in part to its more exposed location, and subsequent increased air leakage, or to exaggerated oil consumption figures. Another explanation could be that the average size stick used for firewood in Black Tickle is smaller than in Cartwright, thus resulting into inflated consumption rates. Based on a demand of 40,303 KWh, the annual electric heating cost per typical house can be calculated as follows:

TABLE 14

Month	Degree Days %	Total KWh	Basic Rate	First 500 KWh @ 4.72 c	500 - 1000 KWh @ 8.83 c	Over 1000 KWh @ 11.98 c	Total Cost
Jan.	16.2	6,529	$ 9.50	$ 23.60	$ 44.15	$ 662.37	$ 739.62
Feb.	14.0	5,643	9.50	23.60	44.15	544.25	621.50
March	12.5	5,038	9.50	23.60	44.15	483.75	561.00
April	8.9	3,587	9.50	23.60	44.15	309.92	387.17
May	5.9	2,378	9.50	23.60	44.15	165.08	242.33

Month	Degree Days %	Total KWh	Basic Rate	First 500 KWh @ 4.72 ¢	500 - 1000 KWh @ 8.83 ¢	Over 1000 KWh @ 11.98 ¢	Total Cost
June	3.0	1,209	$ 9.50	$ 23.60	$ 44.15	$ 25.04	$ 102.29
July	1.3	524	9.50	23.60	2.12	-	35.22
Aug.	2.1	846	9.50	23.60	30.55	-	63.65
Sept.	4.3	1,733	9.50	23.60	44.15	87.81	165.06
Oct.	7.3	2,942	9.50	23.60	44.15	232.65	309.90
Nov.	9.7	3,909	9.50	23.60	44.15	348.50	425.75
Dec.	14.8	5,965	9.50	23.60	44.15	594.81	672.06
Totals	100.0	40,303	$114.00	$283.20	$474.17	$3,454.18	$4,325.55

Please note that this does not even include the fuel adjustment premium.

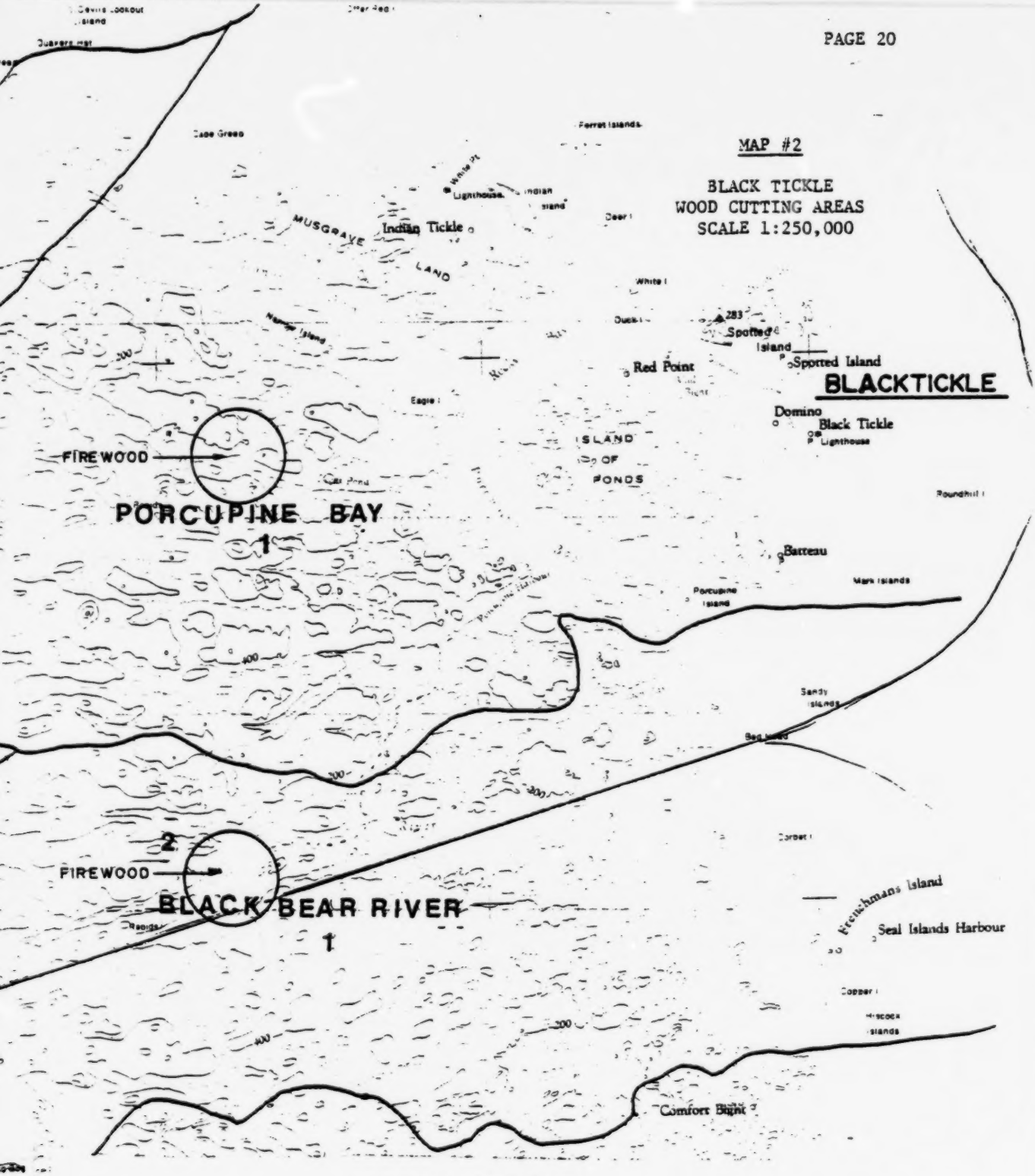
2.10 Wood Heating Cost Analysis for Black Tickle

Questions 17 to 22 were asked to determine the true cost to the homeowner of getting his firewood and looking after his wood stove or furnace. Again, as with Cartwright, the labour component was determined by multiplying the actual hours spent with the minimum wage ($4.00/hour). The average labour cost per 100 sticks of wood (or per cord) in Black Tickle was $176.00. The direct expenses such as for oil and gas for skidoo and chainsaw in Black Tickle were $86.83 per 100 sticks of firewood (per cord). The indirect expenses were $110.37 per 100 sticks of wood for a total cost of $176.00 + $86.83 + $110.37 = $373.20 per 100 sticks.

The total cost was then compared with the distance to the wood supply in Graph 1 on an individual basis. The points found for hauling distances of 15, 16 and 20 miles matched the Cartwright straight line perfectly. The 23, 25 and 26 mile points showed a flattening pattern, while the 30 and 35 mile points showed an actual lower cost per cord, equal to the cost of a 12 - 14 mile haul. One other individual claimed a cost of $725.00 per cord for a 38 mile haul, which was excluded from our survey. The flattening and dropping pattern from 23 - 35 mile can only be rationalized by the fact that at the greater distance, people get in the better stands of timber, where they can cut more and better wood in a smaller period of time thus reducing the cost per 100 sticks, or alternatively they must work harder to get home at regular meal times. The average hauling distance for Black Tickle is currently 26 miles! (Map #2).

Based on the 15 houses who burned exclusively wood, according to our door-to-door survey, the average home needs 1547 sticks per year. Assuming a labour cost of $4.00 per hour, the annual wood heating cost is 1547 sticks x $373.20 per 100 sticks = $5,773.40. Excluding the labour cost, the annual wood heating cost is 1547 sticks x $197.20 per 100 sticks = $3,050.68.

For comparison, the figures for all electric heat were $4,325.55 per year, and exclusively oil heated homes were $4,280.00 per year. It can be clearly seen that if the people put no value on their labour or their time, they can "save" an average of $1,230.00 per year by burning wood instead of oil.


MAP #2
BLACK TICKLE
WOOD CUTTING AREAS
SCALE 1:250,000
Indian Tickle
MUSGRAVE
LAND
Red Point
Spotted Island
BLACKTICKLE
Domino
Black Tickle
Lighthouse
ISLAND
OF
FOGNS
FIREWOOD
PORCUPINE BAY
1
Barreau
Porcupine Island
Mark Islands
Sandy Islands
2
FIREWOOD
BLACK BEAR RIVER
1
Frenchmans Island
Seal Islands Harbour
Hiscock Islands
Comfort Bight
Scale 1:250,000 Échelle
Miles
Kilometres
Transverse Mercator Projection
North American Datum 1927
Contour interval 200 feet
Elevations in feet above Mean Sea Level
Projection Transverse de Mercator
Réseau géodésique nord-américain 1927
Équidistance des courbes: 200 pieds
Élévations en pieds au-dessus du niveau moyen de la mer

The following conclusions can be drawn:

- If the cost of labour is taken into account at $4.00 per hour, wood heat is most expensive.
- If the cost of labour is not valued, wood heat is least expensive ($1,230.00 per year less than oil heating).
- Electric heating is slightly more expensive than oil heating.
- There is tremendous potential for saving by better insulating and weather-stripping the houses and thus reducing overall energy demands.
- There is considerable doubt about the accuracy of the survey returns and energy consumption figures may have been exaggerated.

In question 25, we asked the people of Black Tickle how much they were prepared to pay for 100 sticks of wood. Their answers averaged $60.00 per 100 sticks. Again, like in Cartwright, this was far below the true cost of the wood. Hence, this would enforce the philosophy that people don't consider getting firewood as "working", but rather as a "pastime" or recreational activity. Refer to section 2.5.

The frequency of accidents reported in the past year was as follows (question 24):

Health problems:	18% said yes.
Skidoo damage:	45% said yes.
Komatic damage:	53% said yes.
Chainsaw accidents:	8% said yes.
House fires:	3% said yes.

In question 26 we asked when people converted from oil to wood. The answers were as follows:

Always burned wood:	3
In 1975:	3
In 1979:	2
In 1980:	2
In 1981:	6
In 1982:	9
In 1983:	Nil
In 1984:	Nil
	25
Not applicable:	13
	38

This indicates that the big change took place in 1981 and 1982 with 15 out of 25 or 60% of the people who burn wood now changing over. Obviously, the COSP program has reached this community; it started October 28, 1980.

The answers to the final questions of our interview were all much the same. People feel the heavy burden of not being able to afford the high cost of oil and electricity, and having to go a long distance to get their firewood. If wood could be made available to a central depot in the community for a reasonable cost, they would burn more wood, and thus increase their comfort, or would convert from oil to wood.

Based on the low annual incomes and the high cost of heating in this community, a low cost wood supply would reduce economic and physical hardships. People should also be made more aware of the benefits of retrofitting their houses, because this would greatly reduce their energy requirements. Finally, one other option is the relocation of the community as a whole, however this is outside the scope of this report. The most logical solution is to create a low cost wood supply in the community. The Development Association or Local District Council or a local merchant could, in the summer or fall, arrange for the shipping of a sufficient amount of wood to last the whole community for the winter (e.g. 700 cords). They could store this in a depot and then sell it in komatic or truck load quantities as and when people need it. Wood could be imported from either Cartwright or Goose Bay, whatever is most economical. More about this later in the report.

2.11 Economic Radius for Cartwright Area

Our terms of reference required that we determine the availability of wood fuel within an economic radius of both Cartwright and Black Tickle.

The first problem was to define the economic radius. In Black Tickle people go presently as far as 38 miles to get their firewood, the average distance is 26 miles. In Cartwright people go an average distance of 6 miles, and a maximum of 16 miles, although I have heard of several people who went to Paradise River, a distance of 23 miles to get dry wood in an old burned-over area.

The economic radius of getting firewood depends on many factors such as:

(1) Type and size of wood and accessibility (small, big, spruce, fir, scattered, dense, etc.). In Cartwright, the wood is generally limited to small pockets with barren ground or low scrub in between (see Map #1).

(2) Comparative cost, availability and reliability of other competitive fuels such as electricity and oil, and their escalation rates. Electricity rates are identical in Cartwright and Black Tickle, but stove oil costs in Black Tickle are currently about 10% higher than in Cartwright if bought in small quantities from local dealers. If bought in bulk the cost drops considerably (as much as $1.00 per gallon). Because electricity is generated from oil, it can be safely predicted that future increases in oil prices and in electricity rates will be very much the same. We can further safely predict that although world oil prices may stabilize or even drop a little in the next two years, the long term trend will be a "small but steady increase in the real prices, starting in 1987". (Oil week, January 21, 1985).

(3) Socio/economic value of labour component of getting firewood to the individual. For example, at a labour rate of $4.00 per hour, the cost per 100 sticks in Cartwright is $209.64, while excluding the labour component, this cost is $77.64 per 100 sticks. It will be hard to determine the true value of the labour because no other paid employment is available, and people want to get out of the house anyway during the long winters, so many probably get their wood, regardless of the distance, because there is nothing else to do. Most will get their own firewood to save the $1,200 they would otherwise spend on oil.

(4) Method or equipment used to get firewood. Presently all wood is hauled by skidoo and komatic in the winter. Other options are hauling by boat in the summer or fall, or by road, if an access road was built into a good stand.

(5) The economic climate. If for example, the fisheries has been good, and unemployment payments are high, people will be less inclined to go a far distance than if the area is relatively depressed, with very low or no unemployment benefits.

Before we will attempt to determine the economic radius for hauling wood for Cartwright, we will tabulate our earlier findings:

(1)	Average home requires 24,789 GJ net energy.	
(2)	Annual heating cost with electricity	$2,510.97
(3)	Annual heating cost with oil	1,952.35
(4)	Annual heating cost with wood (including labour)	1,844.83
(5)	Annual heating cost with wood (excluding labour)	683.23
(6)	Extra cost per cord per extra mile haul distance, including cost of labour	18.00
(7)	Extra cost per cord per extra mile haul distance, excluding cost of labour	6.67
(8)	Current fuel wood requirements for Cartwright	114,130 sticks
(9)	Current fuel wood requirements for Black Tickle	31,700 sticks
	Total	145,830 sticks ($3,500\ m^3$)

From the above figures can be seen that the present average haul of six miles is still feasible even with the cost of labour taken into account, wood heating is still cheaper than oil or electric heat. However, it is only marginally cheaper. Assuming that next year people must go one extra mile to get firewood, and burn 8.8 cords per year, the cost of wood heating (including labour) increases to $1,844.83 + 8.8 x $18.00 = $2,003.23, which is higher than the cost of oil heating, assuming no increases in oil prices this year. So, the "true economic radius" is only seven miles.

If we exclude the labour cost of getting wood, for the reasons outlined before, we can calculate another radius which we will define as the "socio-economic radius".

Based on an average consumption of 8.8 cords per home and an extra cost of $6.67/mile, the cost per home per extra mile would be $58.70. We currently have a price differential of $1,952.35 - $683.23 = $1,289.12 between wood and oil, so in theory the socio-economic radius should be $1,289.12 : $58.70 = 22 miles. Since this point still falls within the straight part of Graph 1, and is confirmed by the fact that some people have gone 23 miles to Paradise River, we will consider 23 miles as our "socio-economic radius". This is shown on the attached 1:250,000 topomap (Map #1).

2.12 Availability of Wood in Cartwright Area

The availability of wood in the Cartwright area was obtained from the report "Wood information - Cartwright area" as prepared by the Department of Forestry for the Eagle River Development Association in September 1983.

On Map #1 can be seen that the following forest management blocks are in part or in total in the 23 mile radius of Cartwright. They are tabulated in Table 15, together with their solid wood content in cubic metres. In this table:

B.S. = Commercial black spruce which includes 75% black spruce, 20% balsam fir and 5% other species in this area.
W.B. = Commercial white birch (hardwood).
L.V. = Low volume areas having less than a 60 m^3/ha merchantible volume. These areas are not suitable for pulpwood or sawlog operations, but are suitable for fuelwood and Forestry estimates them to contain an average of 50 m^3 of solid wood per hectare. The proportion of each block within the 23 mile economic radius of Cartwright has been estimated, and the gross volumes of wood within this radius were calculated in Table 15.

TABLE 15

Watershed	Block	Percentage	Solid Wood Content Whole Area in m^3 B.S.	W.B.	L.V.	Solid Wood Center Applicable Area in m^3 B.S.	W.B.	L.V.
North River	1A	100	25,000	-	14,000	25,000	-	14,000
	1B	100	71,000	-	63,000	71,000	-	63,000
	2A	100	290,000	-	115,000	290,000	-	115,000
	2B	100	499,000	-	100,000	499,000	-	100,000
Sandwich Bay	1	100	891,000	35,000	200,000	891,000	35,000	200,000
White Bear River	1	40	893,000	23,000	32,900	357,200	9,200	13,160
Eagle River	1	80	155,000	18,000	85,000	124,000	14,400	68,000
	2	90	69,000	-	93,000	62,100	-	83,700
Paradise River	1	100	264,000	14,000	129,000	264,000	14,000	129,000
	2	60	939,000	-	450,000	563,400	-	270,000
	5	50	256,000	18,000	152,000	128,000	9,000	76,000
Muddy Bay	1	100	604,000	-	816,000	604,000	-	816,000
Sand Hill River	2	10	2,438,000	-	1,260,000	243,800	-	126,000
TOTALS						4,122,500	81,600	2,073,860
PERCENTAGES						66%	1%	33%

Grand total 6,277,960 m^3 of solid wood.

From the above table can be concluded that a total amount of 6,277,960 m^3 of solid wood is available within a 23 mile radius of Cartwright. With a 50% deduction for cull, wastage, inventory errors and inaccessibility, the net amount available is estimated as 3,138,980 m^3. This results in an annual allowable cut of 3,138,980 + 120 = 26,158 m^3.

The breakdown by species and age class on a sustainable yield basis is:

Species	Age Class	Sustainable Yield
75% Black Spruce	Over 120 years	19,619 m^3/year
20% Balsam Fir	Over 120 years	5,231 m^3/year
5% White Birch	Over 120 years	1,308 m^3/year
Total		26,158 m^3/year

This would be quite sufficient to support the current annual demand of both Cartwright and Black Tickle combined (respectively 1,141 + 317 cords = 1,458 cords @ 85 c.f. solid wood per cord = 123,930 c.f. = 3,500 m^3/year).

Presently firewood is cut in the Jackie's Pond Area and along the Goose Cove Path, in the Birdets Brook area within the Town's watershed, and in the Salt Pond area near Muddy Bay Brook (see Map #3). Cutting in the watershed is officially not allowed but not yet enforced. Most other wooded areas within the 23 mile radius of Cartwright are accessible by skidoo, either with or without the construction of access trails. Bad ice in the channels around Diver Island and Earl Island make travel in these areas hazardous. Otherwise travel by skidoo is virtually unlimited. Groomed access trails or access roads into major timber stands would facilitate the harvesting of fuel wood.

One access road has already been planned by the Dept. of Forest Resources & Lands, that is a road from Cartwright to Paradise River. This would lead directly through or near well stocked areas, and because it follows the route of the spur to the proposed Trans Labrador Highway, this road can have long term benefits, far exceeding those of just a forest access road. This access road is shown on Map #1.

Two estimates on the availability of timber along the proposed access road have been prepared by the Department of Forest Resources and Lands. The first one is for a 1 km strip along the proposed route and the second for parts of the two blocks that will be opened up by the road (although some additional road is required) namely Paradise River Block #1 and part of Muddy Bay Block #1. See Table 16.

TABLE 16

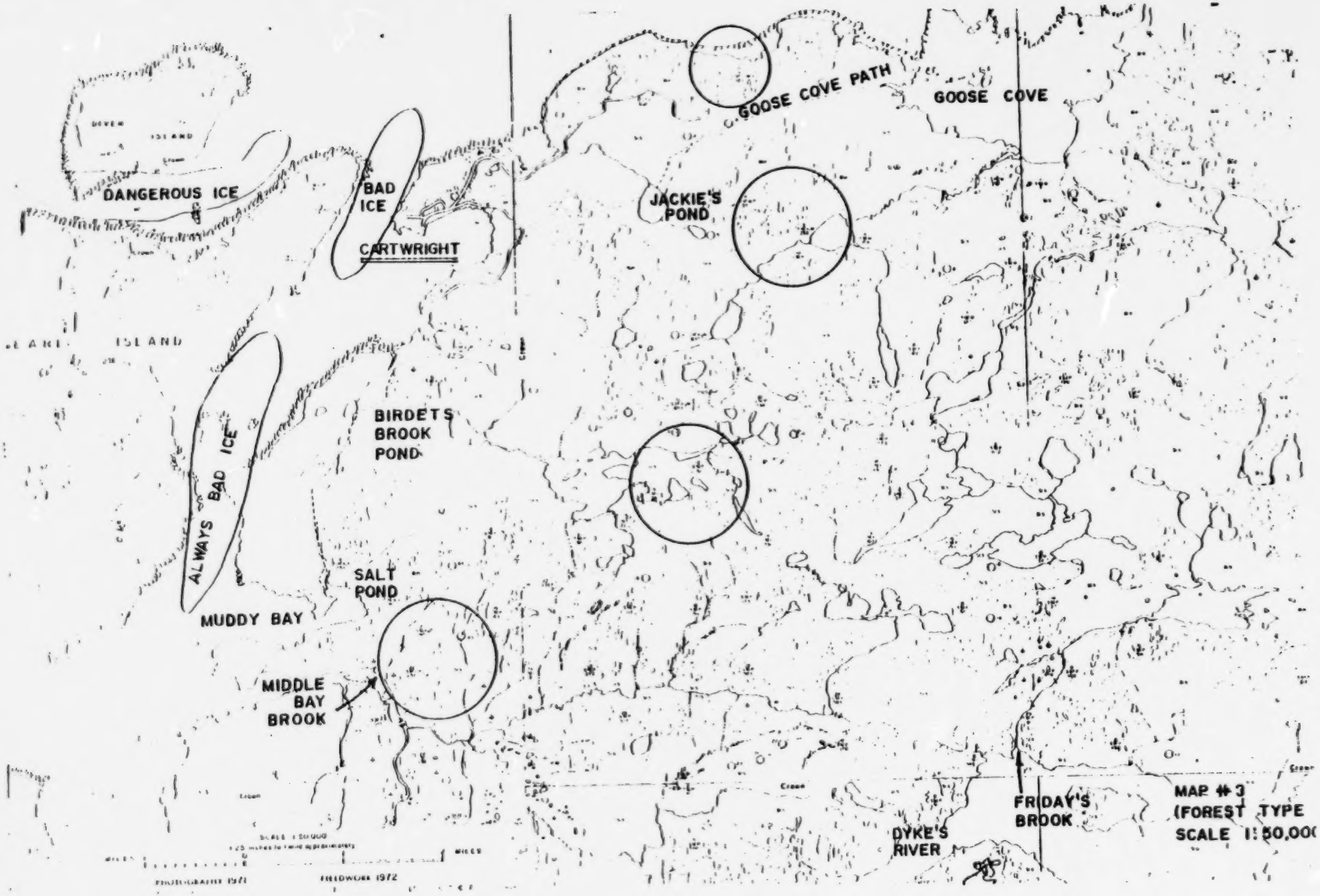
Volume Estimates for Proposed Cartwright - Paradise River Road

A. Accessible from Proposed Road (1 km strip)

Type	Area (Ha)	Volume (m^3)
S4E*	470	40,800
Low Volume (Fuelwood)	1390	69,500
Total		110,300

B. Accessible (Minimum Additional Road)

Block	Type	Area (Ha)	Volume (m^3)
Muddy Bay #1	S4E	1850	156,400
	Low Volume	3290	164,500
Paradise River #1	S4E	3000	264,000
	Hardwood	100	14,000
	Low Volume	1700	85,000
Total	Merchantible	4950	434,400
	Low Volume	4990	249,500
	TOTAL	9940	683,900


GOOSE COVE PATH
GOOSE COVE
DANGEROUS ICE
BAD ICE
CARTWRIGHT
JACKIE'S POND
BIRDETS BROOK POND
ALWAYS BAD ICE
SALT POND
MUDDY BAY
MIDDLE BAY BROOK
FRIDAY'S BROOK
DYKE'S RIVER
MAP #3
(FOREST TYPE
SCALE 1:50,000
FIELDWORK 1972

* S4E means 75 - 100% softwood content, 40' top height, 41 - 70% crown cover. These figures are generated from the intensive global inventory (1975). They represent the gross merchantible volume, without reduction for cull, slopes, inventory discrepancy, restrictiveness, etc. (50%).

Although the access road from Cartwright to Paradise River may not be economical from a forest management viewpoint, if any access road construction would take place to encourage the consumption of fuelwood, and reduce dependency on oil, it would make sense to put the access road in the general direction of Paradise River, along the route proposed by the Department of Forest Resources and Lands, with its infrastructural benefits.

If funding would only be available for the construction or upgrading of a short section of trail, the existing trail to "Dykes River" should be improved and kept groomed. It meets Dykes River near "Friday's Brook". Dykes River is actually an L-shaped pond, that is 11 km (7 miles) from Cartwright and 18 km (11 miles) long. It provides access to some of the largest commercial timber stands in the Cartwright area.

In conclusion, sufficient amounts of fuelwood are available within the 23 mile radius of Cartwright to supply the present and long term future requirements of both Cartwright and Black Tickle on a continuous basis, because the current demand is only 3500 m^3/year and the annual allowable cut is 26,158 m^3/year.

For all intents and purposes, the economic radius for Black Tickle has already been reached, and the two options available for that community are:

- Bring in wood from other areas by Coastal Boat in summer or fall.
- Create a new winter community in an area with a better wood supply.

As outlined above, Cartwright has an ample supply of wood to supply Black Tickle on a long term basis.

2.13 Potential to Increase the Use of Wood as Fuel

2.13.1 Cartwright Residential Heating Fuel Demand

In Table 5 can be seen that the breakdown in net heating fuel consumption is as follows:

Oil:	25%
Wood:	75%
Electricity:	Nil

Obviously, electrical consumption cannot be reduced any further. Oil consumption can probably be reduced very little, because in Section 2.1 we found that 26% of the homes had nobody who was physically able and at the same time unemployed during the winter months. Also, we found that the Federal Government housing had heat and light subsidized by the Government and had therefore no incentive for the occupants to conserve or to convert from oil to wood.

The only ways to reduce oil consumption would be as follows:

(1) Make firewood readily available within the Community, preferably cut, split and delivered to those people who cannot cut their own firewood. This could be done either by a local merchant or by the Development Association setting up and maintaining a fuelwood depot.

(2) Make Government tenants responsible for their cost of home heating, the same as everybody else.

(3) Installing woodstoves in all Government houses and making wood available to the occupants in the same manner that oil is presently made available. This can be done on an individual basis or pooled for all Government buildings together.

(4) Encouraging people to better insulate and weatherproof their homes, thus reducing overall energy requirements.

Although the potential residential oil savings are 34,430 Igallons per year, we estimate that at most 50% of this can realistically be achieved or 17,200 Igals.

2.13.2 Cartwright Commercial Heating Fuel Demand

Table 5 shows that the net total commercial heating fuel demand for Cartwright is broken down as follows:

Oil:	85%
Wood:	15%
Electricity:	Nil

As with the domestic demand, electrical demands cannot be reduced any further. Oil is presently the most popular fuel for the commercial sector because it is virtually labour free, reliable and easy to control thermostatically, which is important for premises that are only occupied 40 - 50 hours per week (24% - 30% of the time). Furthermore, commercial buildings frequently store large amounts of expensive, temperature sensitive materials and require an extremely reliable heating system. Most of the commercial premises just have barely enough manpower to carry out their regular functions, so on an individual basis it would not be feasible for them to convert from oil to wood, and have one person looking after their heating system 24 hours per day, 7 days per week. In the past, the stores were heated with wood however.

The only way that we could see them change over from oil to wood would be if:

(1) Cost of conversion would be subsidized.

(2) They could sign an "energy supply contract", with a reputable and reliable local business or agency, whereby that agency would undertake to supply a group of commercial and institutional buildings with all their annual heating requirements on a contractual basis. Their service would include procuring the wood, cutting it to size, storing it, keeping the furnace filled up, removal of ashes, periodic checks and for automatic alarms of all heating systems under its control.

(3) This energy supply contract would be less expensive and equally reliable as the oil heating system, taking into account all increased insurance rates, and other associated costs.

Such an "energy supply agency" would only be able to operate if a sufficiently large group of business and institutional premises could be serviced together to make it pay for the overhead. A non-profit organization such as a Development Association could probably operate with less overhead than a private enterprise firm. On the other hand, such an energy supply agency would take the fuel business away from the present fuel suppliers and wholesalers, and would therefore cause unfair competition for them. From that viewpoint, the local merchant (Fequet's Enterprises Limited) and/or the wholesalers (Woodward's Oil Limited), should be given the right of first refusal, and should be offered the same infrastructural and other incentives that would be offered to a Development Association. The potential commercial oil savings would theoretically be 5213 Igals per year. Realistically, we expect that only about 50% of this oil saving can be accomplished, or 2,600 Igals per year.

2.13.3 Cartwright Institutional Heating Fuel Demand

Table 5 shows that the net total institutional heating fuel demand for Cartwright is broken down as follows:

Oil:	95%
Wood:	1%
Electricity:	4%

Obviously, electricity consumed as heating fuel cannot be reduced much more, and any increase in woodfuel usage should come from the oil consumption, in line with the Remote Community Demonstration Programs goals. Much the same applies to the institutional sector as the commercial sector. Each institution on its own requires reliability, automatic controls (thermostats) and above all, safety of operation. Again, as with the commercial sector, most institutions don't have the manpower to look after a wood heating system and provide their own wood supply. So therefore, the conditions and requirements for getting institutions to convert from oil to wood are the same as those listed under Section 2.13.2 above. The potential institutional oil savings would theoretically be 28,606 Igals per year. Realistically, we expect that only about 50% of this oil saving can be accomplished or 14,300 Igals.

2.13.4 Black Tickle Residential Heating Fuel Demand

Table 12 shows that the net total residential heating fuel demand for Black Tickle is broken down as follows:

Oil:	53%
Wood:	46%
Electricity:	1%

This is a considerably different picture than in Cartwright. However, because no wood is readily available near the community, the options are to move the wood in from other areas by boat when the shipping season is open, or to create a new winter community nearby a good wood (and water) supply. This last option, although very intriguing, is considered outside the scope of this report and will therefore not be investigated in detail.

The cost of shipping wood in by boat from other communities will be investigated further in this report. As mentioned earlier, the only way that residential oil demands can be reduced in our opinion, are by the creation of a wood fuel depot in the community where people can buy reasonably priced firewood in the same manner that they currently buy drums of fuel.

As outlined in Section 2.13.2, a Development Association or Community Services Council could probably run a fuel wood depot with less overhead than a local merchant could, however if Government funds would be applied to set up the depot and thus to create unfair competition to the local fuel dealer or wholesaler, they should be given the right of first refusal to manage the depot, with the same incentives as would be given to a Development Association or Local Service Council.

We firmly believe that a properly organized fuel wood depot would reduce the fuel oil consumption drastically by as much as 75% and also the amount of fuel burned in snowmobiles to obtain firewood. The potential residential oil savings would theoretically be 33,135 Igals per year. Because wood currently only forms 50% of the fuel used, we expect that a realistic oil saving of 75% is possible, or 24,900 Igals per year.

Furthermore, much emphasis should be placed on energy conservation measures, to reduce oil consumption, and on using more efficient type wood stoves. Obviously, the available benefits of the CHIP program have not yet reached this community, or else people could not afford to make the initial investments which would pay themselves back in very few years.

2.13.5 Black Tickle Commercial Heating Fuel Demand

Table 12 shows that the net total commercial heating fuel demand for Black Tickle is broken down as follows:

Oil:	65%
Wood:	-
Electricity:	35%

The two only commercial premises are the store and the fish plant, which is used as warehouse in the winter, by the store owners. We were advised that they plan to build a new store which will also serve as warehouse, and might consider to install a wood stove, provided wood would be more readily available in the community. They tried to heat their store one full month (March 1984) with electricity only on a trial basis, but had to give it up due to the high cost ($1,800.00).

So, the only way to encourage the commercial sector to utilize more wood and less oil would be to set up a wood storage depot, which they could manage if interested. Mr. George Hudson wrote us that with current low oil sales, it is hardly worth his while to keep one person on staff to look after the fuel retail business. This person could probably look after the wood sales simultaneously, without significantly increasing the overhead of the firm, and look after the wood heating of the store. The potential oil savings are theoretically 1500 Igals per year. With a wood depot managed by the local merchant, this could realistically be reduced by 67% or 1000 Igals per year.

2.13.6 Black Tickle Institutional Heating Fuel Demand

Table 12 shows that the net total institutional heating fuel demand for Black Tickle is broken down as follows:

Oil:	83%
Wood:	Nil
Electricity:	17%

There were three buildings in this category, the clinic, the school and the church. The present clinic was not supposed to be in use as a clinic/nurse's residence this winter because a new clinic was built. Its hot water heating system failed in November before it was ready for occupancy and froze, causing serious damages. The new building should be in use this coming heating season, and although it is oil based, the annual heating costs should be considerably less than they were for the electrically heated old clinic due to higher insulating values and better vapour barriers. It is doubtful that the new clinic will convert to wood heating, as no provision was made for it in the building plans. The school and the church will also not likely convert from oil to wood because they have installed a large oil tank and purchase their fuel in bulk directly from the tanker. This saves them approximately $1.00 per gallon, thus making oil heat very attractive.

In conclusion, because of the small number of commercial and institutional buildings in Black Tickle, we don't consider it feasible to set up an energy supply agency as described in Section 2.13.2 for Cartwright. Although the potential oil savings are 8897 Igals per year, the realistically anticipated oil savings in the institutional sector are negligible.

2.13.7 Cartwright and Black Tickle Power Plant Energy Demand

In Tables 5 and 12, it can be found that the largest energy consumers in each community are the power plants with respectively 67% of the Cartwright and 63% of the Black Tickle overall net energy demand, and 67% of the Cartwright and 63% of the Black Tickle fuel oil demand.

We understand that Acres Consulting Services Limited has recently undertaken a study to convert power plants in Roddickton, Main Brook and Croque, Newfoundland, from oil to wood. They concluded that the scale of operation is the key factor, with Roddickton, the largest of the three power plants, having a payback of about 10 years, Main Brook of over 16 years and Croque, the smallest of the three, having a payback of over 40 years, which is not feasible at all.

Because the Black Tickle power plant has a lower fuel oil consumption than Main Brook, and the Cartwright power plant has less than 1/3 of the oil consumption of the Roddickton plant, we will not investigate this subject any further, and will consider it unfeasible. Although the potential oil savings are quite significant, the realistically anticipated oil savings in the power plant sector are nil.

Only in one way this situation could be reversed. If for example, as part of a new job creation program, the Federal Government would provide the Utility Companies with sufficient incentives to convert all their oil-burning powerplants to wood-burning powerplants (with oil back-up), the wood reserve in the Cartwright area could support both powerplants in Cartwright and Black Tickle for the long-term future.

2.13.8 Summary

All potential oil savings by sector and the realistically obtainable oil savings if some infrastructure is provided, are tabulated below:

TABLE 17

Potential and Realistically Obtainable Oil Savings

Community	Sector	Potential Oil Saving	Realistically Obtainable Oil Saving
Cartwright	Residential	34,430 Igals	17,200 Igals
	Commercial	5,213	2,600
	Institutional	28,606	14,300
	Power Plant	138.800	-
Black Tickle	Residential	33,135	24,900
	Commercial	1,500	1,000
	Institutional	8,897	-
	Power Plant	74,811	-
Totals		325,392 Igals	60,000 Igals

2.14 Logistics of Transporting Wood from Cartwright to Black Tickle

Canadian National provides a regular coastal boat service to the Labrador Coast. In Cartwright and Black Tickle, the shipping season runs from June to November. Shipping is subject to extreme peaks in the demand in the spring of the year, when all stores in Labrador are sold out, and in the fall when they stock up for the winter. Most freight is inbound for Labrador and therefore shipping wood from Cartwright to Black Tickle, on the outbound trip would not create capacity problems, particularly not if wood is shipped during the summer months. CN boats only ship firewood strapped in bundles. With small shipments, CN do their own strapping but the shippers must place the wood in cradles. With larger shipments they make strapping steel and tools available, but the shippers must do the bundling. Regular freight containers are too hard to handle in the smaller communities and with the smaller coastal boats that service Cartwright and Black Tickle, so the common mode of shipping fuel wood is by ¼ - ½ cord bundles. This size can be handled with ordinary payloaders, pick up trucks or full size trucks. To prevent blocking off the dock itself during loading and unloading and to prevent delaying the coastal boat, wood must be stockpiled as close to the dock as possible. Both in Cartwright and Black Tickle, areas suitable for wood storage seem to be available relatively close to the docks. In Cartwright, Fequet's Enterprises Limited have their shop and warehouse within 150 m from the dock.

Mr. Howard Fequet further expressed an interest to use his warehouse as depot for firewood. No detailed fieldwork could be done to select a site for a wood storage yard because of the thick snow cover during the time of our site visit in January 1985, however this can easily be done at a later date by the Development Association.

2.15 Economic Feasibility of Shipping Wood from Cartwright to Black Tickle

Current rates for firewood in Cartwright are $75.00 - $100.00 per 100 sticks (per cord). People in Black Tickle indicated during our survey they would on the average be prepared to pay $60.00 per 100 sticks. So, on this basis, not even taking into account the cost of handling and shipping, it would not be feasible to ship wood to Black Tickle.

When it is viewed from another perspective, namely the cost to produce wood in both communities while taking into account the cost of labour at $4.00 per hour, the picture is somewhat different. In Black Tickle it was found to cost $373.20 per 100 sticks to get firewood, in Cartwright only $209.64. When we contacted CN, we were advised that last year's freight rates were $15.83 per cord plus a $0.068/00 lbs top wharfage charge. These rates will increase in the 1985 shipping season by 15% to respectively $18.20/cord and $0.078 per 100 lbs for a total of $21.32 per cord.

Because the freight rates from Cartwright to Black Tickle are identical to those from Goose Bay to Cartwright or from Goose Bay to Black Tickle, and because all infrastructure for exporting wood is already in place in Goose Bay, we also want to investigate the possibility of shipping wood from Goose Bay to Black Tickle or to Cartwright. This is technically outside the scope of our terms of reference, and would not assist the Eagle River Development Association to create additional employment in their area, however we would feel that the study would not be complete if this option was not discussed.

After a few years of artificially cheap fuel wood in the Goose Bay area due to the Labrador Linerboard Limited bankruptcy, which left approximately 10,000 cords of wood free for the taking at the dock and the old slasher site in Goose Bay, the situation is returning back to normal. Hickey Construction, a local woods contractor, has frequently shipped wood to the Labrador Coast in the past and quoted a rate of $50.00 per cord at the Goose Bay dock. With an additional freight cost of $22.00 in 1985 wood could be placed at the dock in Cartwright or Black Tickle for $72.00 per cord, much cheaper than it can be harvested commercially in Cartwright, unless a proper access road was constructed to the heavily wooded areas.

From Black Tickle's viewpoint, which will not stand to gain increased employment opportunities, like Cartwright does, it would be best if their fuel wood was shipped directly from Goose Bay rather than from Cartwright, because Goose Bay wood would be less expensive for them.

From Cartwright's viewpoint, it would be best if the necessary infrastructure was put in place so that they can get their own wood supplies at a lower cost and would have the added benefit of the extra employment.

2.16 Infrastructure Requirements for Cartwright

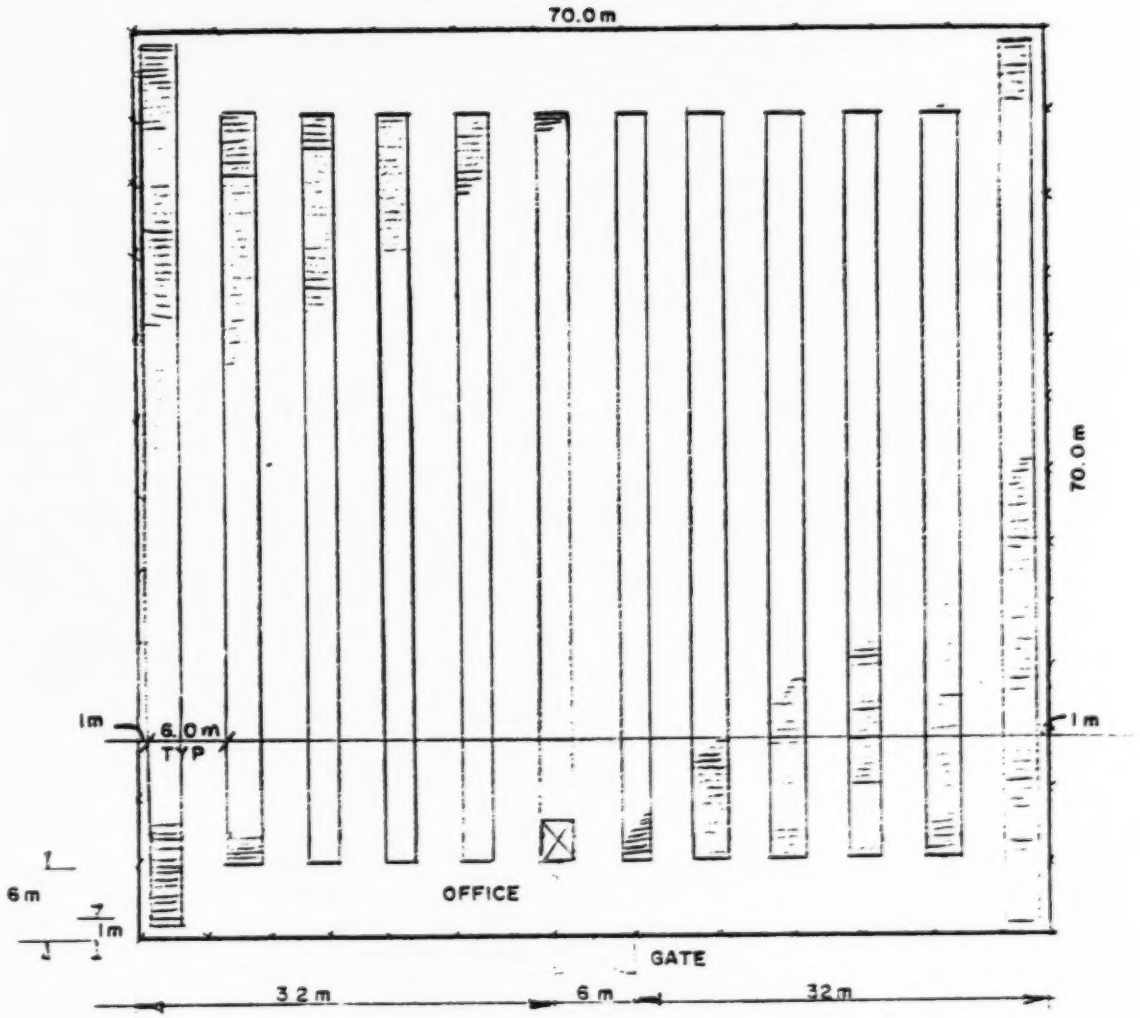
In Cartwright, the most important requirement would be an access road, or groomed trail. An access road of approximately 16 km (10 miles) starting at the end of the new airstrip road would provide access to about half the wood along the Cartwright - Paradise River Road. In Table 16, this was estimated to

be 110,300 m^3 gross volume of solid wood, or with a reduction factor of 50%, it would leave a net volume of approximately 55,000 m^3 or about a 20 year supply based on current consumption levels. The estimated cost of such a road would be $50,000/km for a total cost of $800,000. Other studies to justify this road are presently ongoing as well. The money spent on this road would ultimately help reduce the cost of an access road to the proposed Trans Labrador Highway, one of the main infrastructural requirements for Labrador. The road would have to be equipped with bridges and culverts to make it passable in the summertime. It would have to be cleared of snow in the wintertime to be accessible for trucks. The local roads in the community would have to be kept free of snow as well. During our January visit, most local roads were blocked with snow. With the cooperation of all agencies involved, such as the Department of Transportation, which maintains the airstrip, and the Community Council, it might be possible to keep the road open for about one month in the fall, after the snow stayed down. This would enable the people the best of two worlds. Hauling firewood by skidoo to roadside and trucking it home. At that time, when snow is still not yet very deep, trees could be cut lower to the ground resulting in higher yields and less wastage. A groomed trail would serve some benefit for snowmobile operators, but would not allow the benefits of trucking wood in larger quantities, and is therefore hardly an improvement. Estimated cost of a wide trail cleared of stumps to Dykes River is $100,000.

The second most important infrastructural requirement for Cartwright would be a fenced-in storage yard to prevent people from removing wood unauthorized. With a total annual demand of 1141 cords for Cartwright, and assuming that wood can be piled 2.40 m high, and wood is cut in 2.4 m lengths, a yard of 70 x 70 m would be required (200' x 200', approximately). See Drawing #1. Estimated cost to construct such a storage yard in Cartwright with a 2.40 m high chain link fence with three strands of barbed wire on top, complete with small wood-heated shed is $35,000, including engineering. When wood is not shipped into or out of Cartwright, this storage yard does not require to be near the dock, but can be located near the outskirts of the Community somewhere near the Hydro Plant or the Hospital. Because of the amount of snow cover during our field visit, it was impossible to select a site. The yard should be provided with a small office for record keeping. The availability of a labour force has already been discussed in Section 2.2, the availability of trucks in Section 2.5. Almost every family possesses a snowmobile and komatik.

If an access road is in place, it may be feasible for a small woods contractor to visit Cartwright in the summer or fall for a few weeks with a skidder and truck equipped with pulpwood loader to do the harvesting in a commercial way. This would most likely reduce the cost per cord but would not create as much employment as the manual operation. The amount of wood required on an annual basis is not sufficient for local contractors to equip themselves, unless the equipment is used for different operations during other times of the year (e.g. Sawmill Operation).

As discussed earlier, all wood currently used is in the form of roundwood, and no chippers or automatic loading bins are used in Cartwright. Because of the small scale of most wood burning operations, it is not anticipated that this pattern will change.



Proposed Cartwright
Wood Storage Yard Layout
1150 Cord Capacity
Scale 1:50

DRAWING #1

2.17 Infrastructure Requirements for Black Tickle

Black Tickle would only require a fenced-in yard. To store approximately 400 cords of 2.40 m long wood in piles 2.40 m high, would require a yard of 40 x 47 m (see Drawing #2). To install a 2.4 m high chain link fence with three strands of barbed wire around such a yard would cost $25,000, including engineering and legal surveys.

2.18 Socio-Economic Impact Analysis of Increased Use of Wood Fuel in Cartwright

Many of the socio-economic impacts have been discussed already in the earlier part of this report. In general, the positive aspects of an increased use of wood fuel in Cartwright are:

(1) Creation of local employment during a time of the year when traditionally unemployment is high (winter months), either salaried employment if done on a communal basis, or indirectly paid in the form of savings in cash outlays for oil, if done on an individual basis.

(2) More efficient use of manpower, equipment and the wood resource if wood could be cut in the fall, stood up in piles, and hauled to road side after the snow covered the ground. This should preferably be done early in the winter when roads are still accessible for trucks to haul the wood to the community.

(3) Lower overall cost to the buyers of the fuel wood because of higher efficiency in handling if heavy woods equipment is used to harvest the wood.

(4) Reduced dependency on imported oil, which is one of Canada's energy objectives.

(5) Construction employment in road and yard construction.

(6) More dollars retained in the local economy, so spin-off benefits for local merchants.

(7) Less hardship and risk of injury to people when wood is cut in the obtimum time of the year, rather than when snow is 1.5 m deep.

The negative aspects of an increased use of wood fuel in Cartwright are:

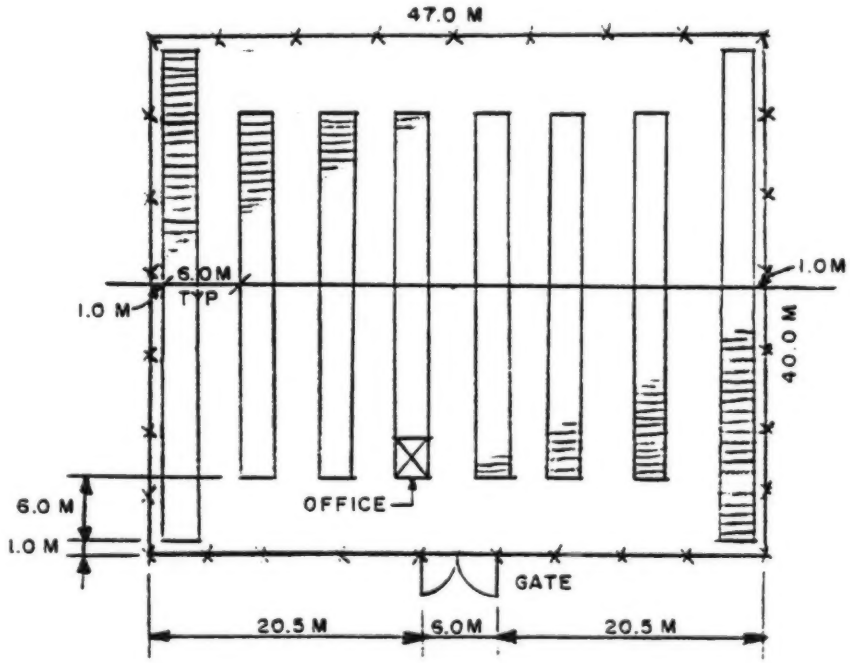
(1) Reduced income for merchants and wholesalers who currently sell fuel, unless alternative arrangements can be made with them for the management of the wood storage yard.

(2) Removal of all major trees near the community leaving a barren environment, more prone to erosion than with the tree cover.

(3) Air pollution will increase due to incomplete combustion of many wood stoves, particularly on very cold, windstill days, when all the smoke hangs in the community.

(4) Increased physical hazards for people due to slips, falls, heavy lifting, etc. in handling and cutting the firewood.

(5) Increased changes for fire damage to dwellings resulting from improper maintenance of chimney, removal of ashes, etc.



Proposed Black Tickle
Wood Storage Yard Layout
400 Cord Capacity
Scale 1:50

DRAWING #2

3. CONCLUSIONS

Upon completion of the investigative and technical discussion part of this report, the following conclusions can be drawn:

3.1 The population in Cartwright is declining slowly, during the past 10 years, in Black Tickle it seems to increase again after a period of stagnation from 1976 - 1981. Current population in Cartwright is about 580 persons, in Black Tickle, about 220 persons.

3.2 The houses in Cartwright and Black Tickle are generally insulated far below the currently recommended levels.

3.3 In Cartwright most people already burn wood: 69% of the homes are completely heated with wood, an additional 16% burn wood in combination with oil or electricity, for a total of 85%.

3.4 In Black Tickle most people burn wood, although the percentages are not quite as high as in Cartwright. In Black Tickle 40% of the houses are heated exclusively with wood, while 21% use wood in combination with oil and electricity for a total of 61%.

3.5 In both Cartwright and Black Tickle an adequate labour force exists to support increased wood consumption on a communal scale, because unemployment is extremely high in the winter months.

3.6 In both Cartwright and Black Tickle wood consumption could not be increased much more on an individual basis, because in Cartwright 26% and in Black Tickle 29% of the homes did not have at least one physically able and unemployed person, who could theoretically provide them with their fuel wood.

3.7 If people burn all wood or mostly wood, they should use only the most efficient "airtight" wood stoves that are presently available, to reduce their consumption and increase their comfort levels.

3.8 Federal Government employees who live in Federally owned housing units in Cartwright have no incentive to conserve or convert from oil to wood because they don't pay for their heating cost, or pay a nominal fee.

3.9 Both in Cartwright and Black Tickle, the power plant is by far the largest oil consumer with 138,800 out of 207,049 Igallons (67%) in Cartwright and 74,811 out of 118,343 Igallons (63%) in Black Tickle. Studies done by others about the feasibility to convert oil burning power plants to wood burning power plants concluded that on a small scale like in Cartwright and Black Tickle, this is not feasible.

3.10 If, to create local employment in remote communities, a Government Program would make it feasible for the Utility Companies to convert their power plants from oil to wood, there is sufficient wood in the Cartwright area to support both power plants in Cartwright and Black Tickle. Such a program would create significant employment and actually create a new wood industry, which would not only benefit but possibly even spearhead the residential, commercial and industrial conversion from oil to wood. It could also support a small scale saw mill industry.

3.11 In Cartwright 91% of the commercial energy demand and 95% of the institutional energy demand is currently supplied by oil. On an individual basis, it is not feasible for each of the establishments to convert from oil to wood. In our opinion, the only way in which they would convert is if:

(1) Cost of conversion would be subsidized.

(2) Low cost wood is readily available.

(3) They could sign an "energy supply contract" with a local agency that would provide them with all their heating requirements including wood, wood storage, loading and cleaning furnaces and periodic checks to ensure that their premises are kept at a certain temperature, 24 hours per day.

(4) Their overall cost is less than the current oil heating cost.

(5) A sufficiently large group of commercial and institutional premises would participate in such a scheme (ideally the power plant as well).

It could not work in Black Tickle because the number of potential users is too small, unless of course, the power plant would participate.

3.12 The annual cost to heat a typical house in Cartwright and Black Tickle exclusively with oil, wood or electricity is tabulated below:

	Cartwright	Black Tickle
Oil heated home	$1,952.35	$4,280.00
Wood heated home including labour	1,844.83	5,773.40
Wood heated home excluding labour	683.23	3,050.68
Electrically heated home	2,510.97	4,325.55

It can be seen that in both communities the cost of heating with wood is the lowest if the labour component is not taken into account. In Cartwright with the labour component included, it is still economically feasible to burn wood, in Black Tickle it is not. We would like to caution that the heating costs in Black Tickle appear high, but we have reported them as they were answered in our door-to-door survey.

3.13 The typical cost and distance to get firewood in Cartwright and Black Tickle was found to be:

	Cartwright	Black Tickle
Direct cost (gas and oil)	$ 36.54/cord	$ 86.83/cord
Indirect cost (repairs and maintenance of snowmobile, komatic, clothing, saw)	41.10/cord	110.37/cord
Subtotal	$ 77.64/cord	$197.20/cord
Labour cost (@ $4.00/hour)	132.00/cord	176.00/cord
Total cost	$209.64/cord	$373.20/cord
Value at which people rate firewood	$88.92/cord	$60.00/cord
Average distance to haul	6 miles	26 miles

3.14 In Cartwright, the cost seemed to increase at a rate of $18.00 per extra mile, up to a distance of about 15 miles. In Black Tickle, in the 15 - 20 mile hauling distance, this relationship was confirmed, but for the greater distances the cost per cord levelled off and actually declined. (See Graph #1)

3.15 In Cartwright, 70% of the people who presently burn wood,-always burned wood. A significant number (22%) switched over since 1980, probably as a result of the COSP program and the high cost of oil. In Black Tickle, the picture is totally different. A total of 60% of the people who now burn wood switched over in 1981 and 1981, an additional 8% in 1980, obviously a result of the COSP program and the high cost of oil. Since August 1983, the Goose Bay office of EMR has processed 20 COSP applications from Cartwright and 3 from Black Tickle.

3.16 Unless access roads or trails are built, or storage depots set up to make wood more readily available to the residents, some of the people who currently burn wood will most likely convert back to oil in the future, as distances increase, and wood becomes harder to get. The state of the local economy will also affect how many people will burn wood at a given time. If the fisheries has been good and unemployment benefits are at their maximum, people will be less inclined to get their own firewood, than if their unemployment benefits are small, or if they don't qualify for any.

3.17 In Cartwright, the economic radius to get firewood by snowmobile based on a labour rate of $4.00 per hour is 7 miles. Presently people are hauling wood an average distance of 6 miles, so the economic radius has practically already been reached. From a strictly economic viewpoint, it would be better for people from Cartwright to import their wood from Goose Bay at a cost of $72.00 per cord, F.O.B. Cartwright dock, than to cut it themselves and haul it by snowmobile. If an access road could be built, it would be feasible for them to get their own wood by skidoo to roadside and truck it to their houses. Excluding the cost of labour, the "socio-economic" radius is 23 miles.

3.18 Within a 23 mile radius of Cartwright is more than enough wood to supply both Cartwright and Black Tickle indefinitely. The annual allowable cut in this radius is 26,000 m^3/year and the combined current domestic, commercial and institutional demand is only 3,500 m^3/year. Even if both power plants and all other heating demands for both communities were supplied from wood, the total annual demand is only 32,048 + 15,433 = 47,481 GJ net energy x 2.0 = 94,962 GJ gross wood energy ÷ 18.5 GJ/cord = 5,133 cords x 2.4 m^3 solid wood/cord = 12,319 m^3/year, or less than 50% of the annual allowable cut in the 23 mile radius.

3.19 A section of 16 km (10 miles) of access road from Cartwright towards Paradise River would provide access to enough wood to supply the current Cartwright demand for the next 20 years. It would follow the route of the proposed Cartwright spur to the Trans Labrador Highway and therefore its ultimate benefits would far exceed the short term benefits of providing truck access to fuel wood stands. Estimated cost is $800,000 (rough estimate).

3.20 If no funds are available for the access road, a cleared trail into the Dykes River area would enable a snowgroomer to maintain a reasonable trail during the winter months. Dykes River itself would provide access to large stands of timber with many years supply. Estimated cost is $100,000 (rough estimate).

3.21 If an access road or trail is constructed in Cartwright and a local fuel wood depot is set up, it can be located on the outskirts of the community. It should be approximately 70 x 70 m with a chain link fence around it, lockable gate and small office shed. Estimated cost to provide this is $35,000. If, on the other hand, no funds are available for access road or trail construction, and it is decided to import wood from Goose Bay, a storage yard should be set up near the dock at a slightly higher cost ($40,000).

3.22 In Black Tickle the only way to increase wood consumption and reduce oil consumption is by importing wood and setting up a depot. Estimated cost of a 400 cord fenced storage yard is $25,000.

3.23 In Black Tickle wood can most economically be imported from Goose Bay at a cost of approximately $72.00 per cord F.O.B. Black Tickle dock, because Goose Bay has the necessary infra-structure and heavy equipment to work efficiently, while Cartwright does not.

3.24 Shipping should be done in ½ - 1/8 cord bundles that can easily be handled by the small coastal boats and pickup trucks.

3.25 Maximum potential oil savings and realistically achievable savings for Cartwright and Black Tickle for the various sectors are tabulated below, expressed in Imperial Gallons:

	Cartwright		Black Tickle	
	Maximum	Realistic	Maximum	Realistic
Residential	34,430	17,200	33,135	24,900
Commercial	5,213	2,600	1,500	1,000
Institutional	28,606	14,300	8,897	Nil
Power Plant	138,800	Nil	74,811	Nil
Total	207,049	34,100	118,343	25,900

Grand total of realistically achievable fuel oil reduction for Cartwright and Black Tickle is 60,000 Igallons per year.

3.26 Importing wood by boat from Goose Bay would also reduce gasoline consumption related to hauling wood by skidoo. In Cartwright alone this is currently 15,600 Igallons per year, so the total gasoline usage reduction resulting from importing wood into both communities would be approximately 10,000 Imperial Gallons.

3.27 The socio-economic benefits of an increased usage of wood as fuel clearly outweigh the negative aspects. Benefits include increased local employment, lower heating cost, utilization of renewable resource that is presently under utilized, reduced dependency of wildly fluctuating oil prices. Negative aspects include reduced profits by oil dealers and wholesalers, removal of trees near the community leaving a barren, less attractive environment, increased air pollution due to incomplete combustion of many stoves, more risk of physical injury due to slips, falls, heavy lifting, etc. in handling and curring firewood, and finally increased risk for house fires due to improper maintenance of chimneys or cleaning of stoves. The negative aspect on the local merchants can be mitigated by letting them manage the wood depot on a business like basis, after its initial set-up. They could lease it from the Development Association for example.

The negative environmental aspects could be mitigated by reforestation and a strict enforcement of Forestry Regulations, which prohibit cutting near ponds, streams and roads.

3.28 If the fuel wood depots would be constructed under a Canada Works or similar "make work" project, their security fence could be made out of locally produced lumber to increase the labour component and decrease the material cost. It would be up to the Development Association to sponsor such a project.

4. RECOMMENDATIONS

Based on the conclusions in the previous section, we would like to make the following recommendations:

4.1 The Local Development Association should sponsor a seminar in Cartwright and distribute available literature emphasizing the benefits of insulating and weatherstripping the homes. Much of this work can be done by the homeowners themselves. It should also make people aware of the availability of modern, more energy efficient wood stoves. This would reduce energy consumption of both oil and wood, and reduce heating costs.

4.2 Fenced wood storage depots should be constructed by the Development Association with funding provided by Government Job Creation and/or off-oil conversion programs. Estimated cost is $60,000 ($35,000 for Cartwright, $25,000 for Black Tickle).

4.3 Wood storage depots should be publicly offered for lease to local business men on the basis of the highest bidder, with conditions attached to ensure that they will be used for the intended purpose.

4.4 If no local business men are interested, business men from outside the area should be considered, and if none are interested, the Development Association shall run the depots for a year on a trial basis, to iron out the bugs, and then try again to transfer them to the private sector, if they have proven to be commercially viable. Wood for the Black Tickle depot should be shipped from Goose Bay, for the Cartwright depot, obtained locally if possible, or imported from Goose Bay as well, whatever is most economical.

4.5 If funding is available, an access road should be built in the direction of Paradise River, connecting to the recently built airstrip road. Estimated cost for 16 km is $800,000.

4.6 If funding of this magnitude is not available, a trail to the intersection of Friday's Brook and Dykes River should be widened (stumps removed) to enable a snowgroomer to work on it. Estimated cost $100,000.

4.7 The Federal Government, with its own houses in Cartwright, should make its tenants responsible for their own heat to reduce wastage and provide an incentive for burning more wood and less oil. Alternatively, energy efficient wood stoves should be installed in all Government housing units, and wood purchased for them locally. This would not only help its "off-oil" conversion program, but also create the badly needed local employment.

4.8 The Federal and/or Provincial Government, on a much larger scale, should encourage and assist Newfoundland and Labrador Hydro sufficiently to make it feasible for them to add wood burning generators to the oil-fired generators, and maintain the oil-fired ones as standby only. This would have a major impact on oil consumption levels and local employment.

4.9 The Development Association should encourage and assist local business men to set up an "Energy Supply Agency" for all commercial and institutional properties in Cartwright. If local business men show no interest to manage it, the Development Association should set up such an agency itself, provided there is sufficient interest to participate and Government subsidies can be made available for the conversion.

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APPENDIX "A"

THIS WORK STATEMENT IS ANNEX "A" TO THE AGREEMENT BETWEEN THE EAGLE RIVER DEVELOPMENT ASSOCIATION AND TERPSTRA ENGINEERING LIMITED.

1.0 Objective

This study is being carried out to assess the potential to increase the use of biomass fuel in the communities of Cartwright and Black Tickle. The study will determine the current level of wood fuel usage, estimate the potential to increase this usage and determine the availability of the resource to meet current and future demands. The study will establish the feasibility of supplying wood to Black Tickle from the resource located in the Cartwright area. Finally, the study will address the social and economic justification for establishing the necessary infrastructure required to increase the level of wood usage in both Cartwright and Black Tickle.

2.0 Study Management Committee

A study management committee will be established consisting of one representative of each of the following:

- Eagle River Development Association.
- Energy, Mines and Resources Canada.

Expenses associated with this committee will be at each representative's cost.

3.0 Scope of Work

This study is to be carried out utilizing all the available information on the communities and the resource from the following provincial and federal government departments:

- Department of Forest Resources and Lands.
- Department of Mines and Energy.
- Newfoundland Statistics Agency.
- Energy, Mines and Resources Canada.
- Statistics Canada.

3.1 Current consumption levels will be determined for light fuel oil, stove oil, electricity and wood as heating fuels in the communities of Cartwright and Black Tickle. The consumption levels will be categorized into residential, commercial and institutional sector consumption.

3.2 The availability of wood fuel within an economic radius of both Cartwright and Black Tickle will be determined. The investigation will be based upon information available from the Department of Forest Resources and Lands such as aerial photography and forest type mapping.

The analysis will be expected to result in gross annual estimates by species and age class on a sustainable yield basis.

3.3 Based upon current levels of consumption by fuel type and sector, estimate the potential to increase the use of wood as a replacement fuel for light oil, stove oil and electricity used for space heating in both communities. This analysis will use the information on the availability of wood determined in Section 3.2. This potential will allow for technology and economic considerations. In addition any surplus availability of the wood resource in the Cartwright area will be considered for use by the community of Black Tickle. This analysis will consider the logistics of transporting the wood from Cartwright to Black Tickle.

3.4 The economic feasibility of shipping wood from Cartwright to Black Tickle to meet the demand identified in Section 3.3 will be determined.

3.5 An analysis of the infrastructure requirements to produce wood in the form and quantities identified in Section 3.4 will be carried out. Considerations will be given to access road requirements, availability of labour force, availability of equipment, the form of wood fuel, i.e. chips for roundwood, etc.

3.6 A socio-economic impact analysis of the increased use of wood fuel in both communities of Black Tickle and Cartwright will be conducted. This analysis will consider additional employment, local economy, etc.

3.7 A draft final report will be submitted to the study management committee for comments. It will contain a minimum of:

- Table of Contents.
- Executive Summary.
- Introduction.
- Technical and Economic Discussion.
- Conclusions.
- Recommendations.
- Bibliography.

Comments will be taken into consideration and a final report prepared. One (1) unbound original reproducible and five (5) copies will be given to EMR.

QUESTIONNAIRE

BIOMASS STUDY FOR CARTWRIGHT

Carried out by: Terpstra Engineering Limited, Goose Bay, Labrador
For: Eagle River Development Association
With funding from: Energy, Mines and Resources Canada

Objective:

This study is being carried out to assess the potential to increase the use of wood fuel in the communities of Cartwright and Black Tickle. The study will determine the amount of wood fuel used, to see whether its use can be increased, and determine the availability of the resource to meet current and future demands. The study will establish whether the supplying of wood to Black Tickle from Cartwright will be worthwhile. Finally, the study will address the social and economic need for setting up the necessary basis required to increase the level of wood usage in both Black Tickle and Cartwright.

Questions:	Answers
1. Name	_____
2. Is building (1) residential; (2) commercial; or (3) institutional	_____
3. Number of adults in home (18 or over)	_____
4. Number of children in home (under 18)	_____
5. Number of people physically able to get firewood (16 & over)	_____
6. Are they normally employed during the winter months	_____
7. Approximate size of building (in feet x feet x storeys)	___x___x___
8. Insulation thickness in basement (in inches)	_____
9. Insulation thickness in walls (in inches)	_____
10. Insulation thickness in attic (in inches)	_____
11. Heating system (1) oil; (2) wood; (3) electricity or combination (1/2) or (1/3) etc.	_____
12. Annual heating cost for oil (---- gallons/year)	_____
13. Annual amount of wood used (in sticks)	_____
14. How many electric heaters do you have	_____
15. What size are they (average) in watts e.g. 500, 1000, 1250, 1500 watts	_____

QUESTIONNAIRE

BIOMASS STUDY FOR CARTWRIGHT

16. (a) How often are they used in hours/week _____

(b) How many weeks per year (average) _____

17. How many hours do you spend each week to get your wood supply ready to burn (including sawing up and splitting) _____

18. How many weeks do you work at your wood supply each season _____

19. What do you pay for gas and oil for skidoo and chainsaw each trip _____

20. How much wood do you bring each trip _____

21. How much do you pay on repairs and maintenance each year on skidoo and chainsaw _____

22. How much do you pay for other related expenses _____

23. How many miles to get to wood supply _____

24. Accidents occurred during past year as a result of burning wood

Health problems (backs, etc.) _____
Skidoo damage _____
Komatic damage _____
Chain saw accidents _____
House fires _____

25. How much would you pay for 100 sticks of wood _____

26. When did you change from mostly oil to mostly wood to heat your house _____

27. What would encourage you to burn more wood? _____

_____

_____

_____

28. Comments by interviewer: _____

_____

_____

Date: Signature of Interviewer:

APPENDIX "C"

CONVERSION FACTORS USED TO CONVERT WOOD FROM STICKS TO GIGAJOULES

100 sticks = 1 cord.

1 cord = approximately 85 c.f. of solid wood = approximately 2.4 m^3 solid wood. Assume the wood is 90% spruce with specific gravity of 0.44 and 10% fir with specific gravity 0.34 (The Forest of Labrador, by W.C. Wilton). So, average specific gravity is 0.43 for Labrador. 1 cord of bone dry wood therefore weighs 2.4 x 0.43 = 1.032 tonne = 2276 lbs. Assume the wood is used at 40% moisture content (on a "wet" basis), because most of it is burned within 1 - 2 months of cutting. The green weight can be calculated with the following formula:

$$\text{Moisture content (wet basis)} = \frac{\text{green weight - bone dry weight}}{\text{green weight}}.$$

$$\text{OR } 0.40 = \frac{\text{green weight - 1.032 tonne}}{\text{green weight}}.$$

$$\text{OR green weight} = \frac{1.032 \text{ tonne}}{0.6} = 1.72 \text{ tonne/cord} = 3793 \text{ lbs./cord.}$$

Higher Heating Value (H.H.V.) of all wood is approximately the same or 8500 BTU/lb. (based on bone dry weight).
Net Heating Value (N.H.V.) can be calculated with the following formula:

$$\text{N.H.V.} = \text{H.H.V.} \left(1 - \frac{\text{M.C.}}{100}\right) - \left(L_{H_2O} \times \frac{\text{M.C.}}{100}\right).$$

Whereby M.C. = Moisture Content on a "wet" basis in %.
L_{H_2O} = Latent Heat of Water = 1200 BTU/lb.

In our case, N.H.V. = 8500 (1 -0.40) - 1200 x 0.40 = 4620 BTU/lb.
= 4620 x 3793 BTU/cord = 4620 x 3793 x 1.055 x 10^{-6} = 18.5 G.J./cord
or N.H.V. = 4620 x 2205 x 1.055 x 10^{-6} G.J./tonne = 10.75 G.J./tonne.

So, 100 sticks = 1 cord = 18.5 G.J.

or, 1 tonne = 10.75 G.J.

Notes:

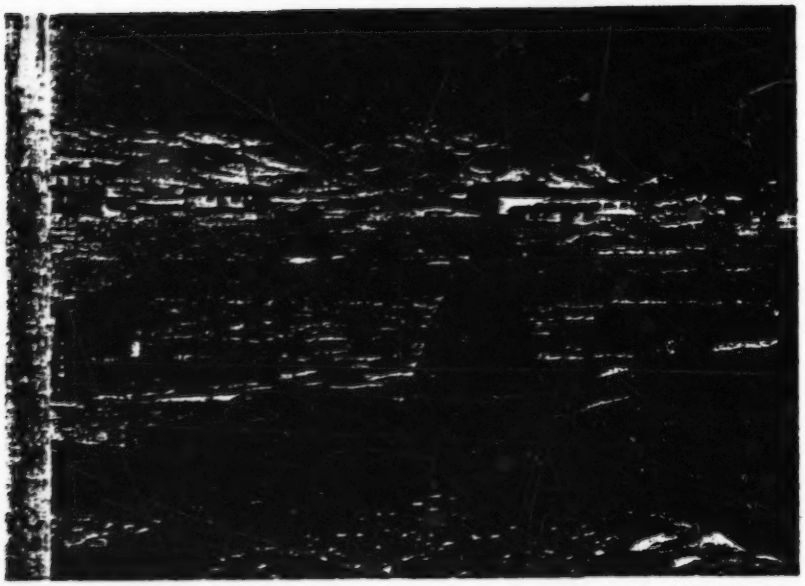
1. Furnace efficiencies have not yet been incorporated.
2. Please note that the conversion factor used in the Overview Study was:

   1 tonne = 8.0877 G.J.,

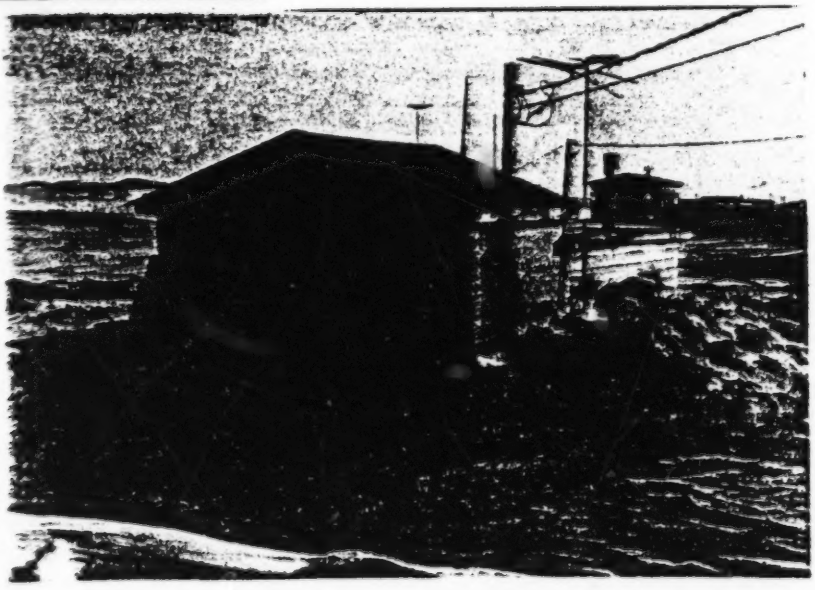
   without any explanation of the assumptions used, and without any differentiation for the South Coast of Newfoundland and Northern Labrador. Because of the higher density of the Labrador wood (e.g. Labrador spruce has S.G. of 0.44 versus 0.40 for Newfoundland spruce; Labrador balsam fir has S.G. of 0.34 versus 0.33 for Newfoundland balsam fir), we are satisfied that our higher heating conversion rate is correct.

APPENDIX "D"

Black Tickle, Labrador
January, 1985

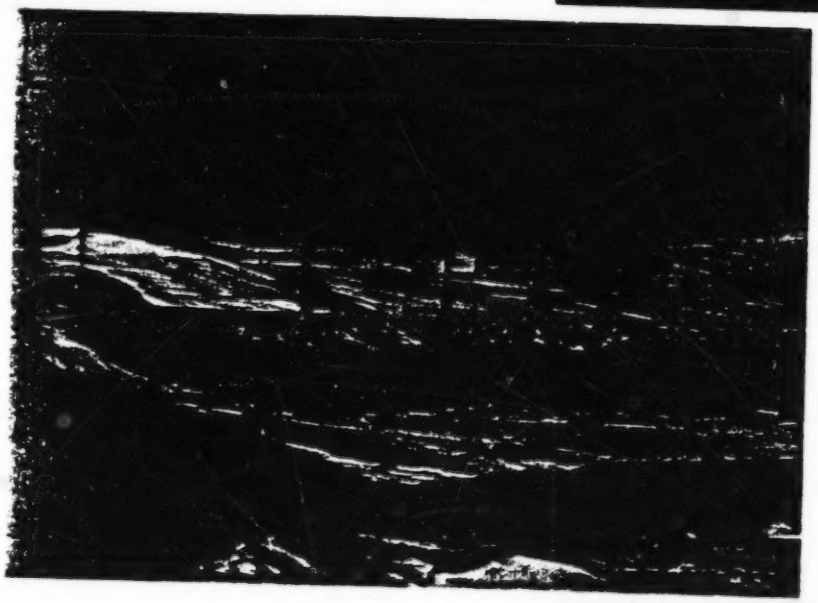


Woodpile of locally cut wood
Black Tickle, Labrador



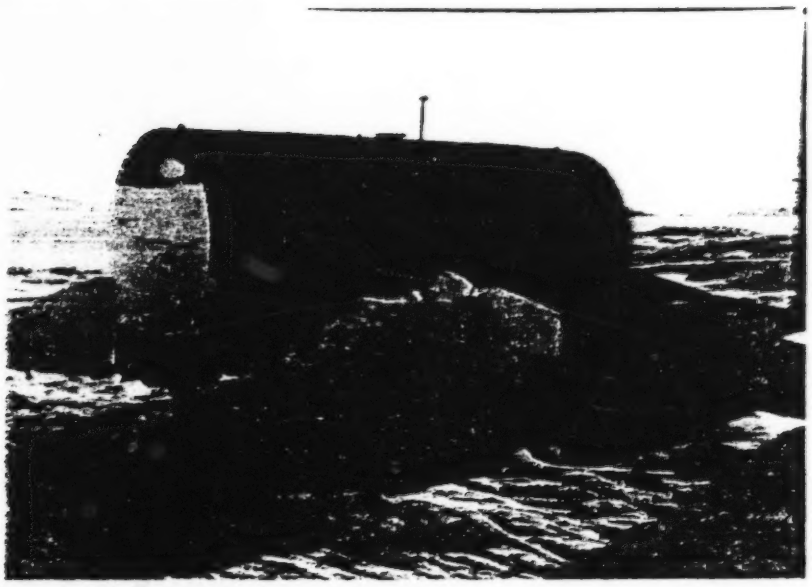
Woodpile of imported wood
Black Tickle, Labrador

Black Tickle, Labrador
Government Wharf



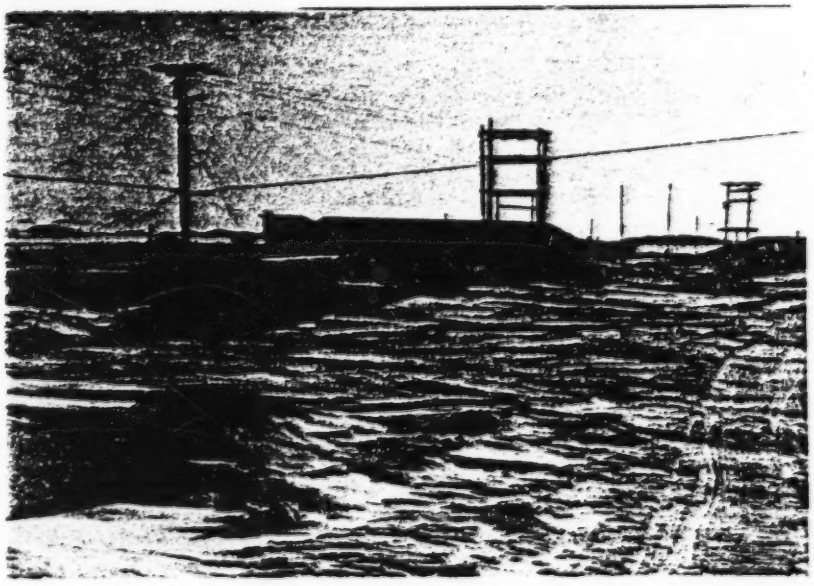
Jib Cranes on fishplant wharf
Black Tickle, Labrador

Open space near wharf in
Black Tickle, Labrador
suitable for wood storage



Oil storage tank
for domestic use
Black Tickle, Labrador

Oil storage tanks for Hydro
Plant, Black Tickle, Labrador



Open space near Hydro trailer,
Hydro Plant, Fish Plant, and
wharf, Black Tickle, Labrador